

APPENDIX I

*CALFED Bay-Delta Program
Appendices - Phase I Summary Report*

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APPENDIX I - SUMMARY OF 100 DRAFT SINGLE FOCUS ALTERNATIVES

Three teams were formed with the goal of generating about 100 preliminary alternatives capable of resolving Delta conflicts and addressing stakeholder concerns. These teams focused on fisheries production/diversion effects reduction (Team A), water supply and demand (Team B), and habitat/land use/water quality (Team C). They generated a total of 100 alternatives.

Team members were generally guided by a five-step "Recipe for Generation of Preliminary Alternatives." Step 1 was the selection description of the theme, subtheme, and approach to be used in generating the alternative. Themes were developed based on the eight conflict resolution strategies used to develop the 32 edge alternatives. These eight strategies served as the focal point around which actions were assembled into alternatives, and included:

1. Enhance fish populations by increasing fish productivity;
2. Enhance fish populations by reducing diversion impacts on fish;
3. Improve habitat quality without converting existing land use patterns;
4. Improve habitat quality and quantity through conversion of existing land uses;
5. Reduce competition for water during critical periods by reducing demand;
6. Reduce competition for water during critical periods by increasing supply availability;
7. Improve water quality by reducing pollutant discharges to the Bay-Delta system; and
8. Improve water quality by increasing instream management measures.

Subthemes were used to focus an alternative on one or more generally accepted strategies for achieving the objectives of the overriding, more broadly described themes. Within each subtheme, one or more "approaches" provided additional focus, and variation, on how the objectives of the themes could be achieved. Each theme, subtheme, and approach combination was then used to select actions that in combination constituted a draft alternative. These combinations served to capture many of the generally proposed solutions to resolving conflicts in the Bay-Delta system while simultaneously addressing most stakeholder concerns.

For example, for the theme titled 'Enhance fish populations by increasing fish productivity,' two different subthemes could be to either (1) increase the populations of commercial species, or (2) increase the population of listed species. Further, for each of these two subthemes, any of three (or perhaps more) of the following approaches could be used, including (1) increase hatchery

production, (2) increase aquatic habitat, and (3) manage instream flows and/or temperatures.

Actions were then assembled consistent with the selected approaches and subthemes. In addition to the core actions (common to all alternatives), other key and supporting actions were added, at varying levels of implementation, so that a reasonable degree of stakeholder equity was achieved upon completion of each alternative. Depending on the particular team, and authors within each team, the alternatives were formatted slightly differently to allow major "themes" of the alternatives to be emphasized.

Examination of the 100 preliminary alternatives indicates that the authors often used the same title, which often coincides with a common theme for the particular group of alternatives being reviewed. However, in most cases, the theme and approach may vary from other alternatives. When the title, theme, subtheme, and approach are very similar, or perhaps apparently the same across some alternatives, the authors would increase the level of implementation of some actions, and decrease the level of others to give each alternative its own particular emphases.

The following summaries of the 100 draft alternatives include the preliminary alternative number, followed by its title, a listing of the theme, subtheme, and approach used, and either a narrative "Solution Overview" of the alternative, or a listing and/or brief explanation of the key actions selected. The "Solution Overview" summarizes the intent of the alternative to overcome conflicts in the Bay-Delta system and achieve program objectives.

Supporting documentation indicating the specific set of actions selected, their intended level of implementation for a particular alternative, and additional insights regarding each alternative's hypothesized performance if actually implemented are available for review at the CALFED offices.

| Preliminary Alternative 101 | |
|---|--|
| Improve Water Quality Primarily by Treating Agricultural Wastewater. | |
| <i>Theme:</i> | Improve water quality by reducing pollutant discharges to the Bay-Delta system |
| <i>Subtheme:</i> | Reduce pollutant discharges from agricultural sources |
| <i>Approach:</i> | Increased level of treatment for discharges. |
| <u>Solution Overview or Key Actions</u> This alternative was intended to treat agricultural drainage, and included all actions for agricultural drainage treatment at the maximum level of implementation. Farmers, municipal and industrial users, and mine owners would be adversely impacted by this alternative. Other actions were therefore added to reduce perceived economic impacts to these user groups, and to otherwise balance achievement of the program objectives in an equitable manner. | |

| Preliminary Alternative 102 | |
|--|--|
| Improve Water Quality Primarily by Reducing Agricultural Wastewater Generation by Modifying Land Use Patterns and Practices. | |
| <i>Theme:</i> | Improve water quality by reducing pollutant discharges to the Bay-Delta system |
| <i>Subtheme:</i> | Reduce pollutant discharges from agricultural sources |
| <i>Approach:</i> | Modify land use patterns and practices to reduce discharges |
| <u>Solution Overview or Key Actions</u> This alternative was intended to minimize the quantities of agricultural drainage from farmlands. It calls for actions that reduce pollutant discharges to the Delta. Farmers, municipal and industrial users, and mine owners would be adversely impacted by this alternative. Other actions were therefore added to reduce perceived economic impacts to these user groups, and to otherwise balance achievement of the program objectives in an equitable manner. | |

| Preliminary Alternative 103 | |
|---|--|
| Improving Water Quality Primarily by Reducing the Volume of Agricultural Wastewater Generation and the Timing of Discharges to Coincide with High In-stream Flows. | |
| <i>Theme:</i> | Improve water quality by reducing pollutant discharges to the Bay-Delta system |
| <i>Subtheme:</i> | Reduce pollutant discharges from agricultural sources |
| <i>Approach:</i> | Control volume and timing of discharges |
| <u>Solution Overview or Key Actions</u> Selected all actions to minimize the volume of agricultural drainage from farmlands and takes advantage of the dilution capacity of streams by synchronizing discharges with periods of high stream flows. Farmers, municipal and industrial users, and mine owners would be adversely impacted by this alternative. Other actions were therefore added to reduce perceived economic impacts to these user groups, and to otherwise balance achievement of the program objectives in an equitable manner. | |

| Preliminary Alternative 104 | |
|--|--|
| Improving Water Quality Primarily by Treating Municipal Runoff and Municipal and Industrial Wastewater. | |
| <i>Theme:</i> | Improve water quality by reducing pollutant discharges to the Bay-Delta system |
| <i>Subtheme:</i> | Reduce pollutant discharges from municipal/industrial sources |
| <i>Approach:</i> | Increase levels of treatment for discharges. |
| <u>Solution Overview or Key Actions</u> Selected all actions to treat municipal and industrial waste discharges and stormwater runoff, including implementing core actions for treatment of those sources at the maximum level. Farmers, municipal and industrial users, and mine owners would be adversely impacted by this alternative. Other actions were therefore added to reduce perceived economic impacts to these user groups, and to otherwise balance achievement of the program objectives in an equitable manner. | |

| Preliminary Alternative 105 | |
|--|--|
| Improving Water Quality Primarily by Reducing the Volume of Municipal and Industrial Wastewater Generation and the Timing of Wastewater and Runoff Discharges to Coincide with High In-stream Flows. | |
| <i>Theme:</i> | Improve water quality by reducing pollutant discharges to the Bay-Delta system |
| <i>Subtheme:</i> | Reduce pollutant discharges from municipal and industrial sources |
| <i>Approach:</i> | Control volume and timing of discharges |
| <u>Solution Overview or Key Actions</u> Selected all actions to minimize the volume of municipal and industrial discharges and to take advantage of the dilution capacity of streams by synchronizing discharges with periods of high stream flows. Municipal and industrial users and mine owners would be adversely impacted by this alternative. Other actions were therefore added to reduce perceived economic impacts to these user groups, and to otherwise balance achievement of the program objectives in an equitable manner. | |

| Preliminary Alternative 106 | |
|---|--|
| Improve Ecosystem Water Quality by Increasing Instream Flows to Dilute Contaminants Using Stored Water. | |
| <i>Theme:</i> | Improve water quality by increasing instream management measures |
| <i>Subtheme:</i> | Increase instream flows to dilute pollutant discharges |
| <i>Approach:</i> | Increase yield by increasing runoff and adding storage to improve ecosystem water quality. |
| <u>Solution Overview or Key Actions</u> Includes all actions to store water upstream or in the Delta to improve water quality by making releases timed to coincide with periods of poor water quality. Also includes at the maximum all core actions that increase instream flows at times when they would be beneficial, since these support the main theme. In some cases core actions designed to provide other benefits were included to be implemented in a manner beneficial to water quality. Non-ecological water users would be impacted by these actions, so actions to supplement the water supply were also included to achieve equity. | |

| Preliminary Alternative 107 | |
|---|--|
| Improve the water quality for Delta diversions by increasing instream flows to dilute contaminants using stored water. | |
| <i>Theme:</i> | Improve water quality by increasing instream management measures |
| <i>Subtheme:</i> | Increase instream flows to dilute pollutant discharges |
| <i>Approach:</i> | Increase yield by increasing runoff and adding storage to improve water quality for Delta diversions |
| <u>Solution Overview or Key Actions</u> Includes all actions to store water upstream or in the Delta to improve water quality by making releases timed to coincide with periods of poor water quality. Also includes at the maximum all core actions that increase instream flows at times when they would be beneficial, since these support the main theme. In some cases core actions designed to provide other benefits were included to be implemented in a manner beneficial to water quality. Non-ecological water users would be impacted by these actions, so actions to supplement the water supply were also included to achieve equity. | |

| Preliminary Alternative 108 | |
|--|--|
| Improve Ecosystem Water Quality Primarily by Diluting or Avoiding Contaminants Dissolved in the Source Waters by Increasing Flows Through Reduction of Water Demands and Changing the Timing of Diversions. | |
| <i>Theme:</i> | Increase instream and Delta flows to dilute contaminants and avoid diversions when water quality is poor |
| <i>Subtheme:</i> | Increase flows by reducing water demands and changing the timing of diversions |
| <i>Approach:</i> | To improve water quality to meet ecosystem requirements |
| <u>Solution Overview or Key Actions</u> This alternative improves water quality for ecological needs by utilizing three types of actions that 1) serve to increase quantities of water available in the Delta and tributary instream flows in order to dilute the concentrations of contaminants; 2) alter the timing of Delta and upstream diversions in order to leave more water available in the system for dilution; and 3) change the timing of diversions to avoid periods of poor water quality. All core measures that reduce the quantities of contaminants entering the aquatic system are included because those actions support the main theme. Equity actions are included to reduce impacts on water users who must make do with smaller supplies. The overall improvement in the quality of diverted and delivered water supplies is in itself a benefit that helps to achieve equity. | |

| Preliminary Alternative 109 | |
|---|--|
| Improve Diversion and Service Area Water Quality Primarily by Diluting or Avoiding Contaminants Dissolved in the Source Waters by Increasing Flows Through Reduction of Water Demands and Changing the Timing of Diversions. | |
| <i>Theme:</i> | Increase instream and Delta flows to dilute contaminants and avoid diversions when water quality is poor |
| <i>Subtheme:</i> | Increase flows by reducing water demands and changing the timing of diversions |
| <i>Approach:</i> | To improve water quality to meet diversion and export beneficial use requirements. |

Solution Overview or Key Actions

This alternative improves water quality for export and diversion needs by utilizing three types of actions that 1) serve to increase quantities of water available in the Delta and tributary instream flows in order to dilute the concentrations of contaminants; 2) alter the timing of Delta and upstream diversions in order to leave more water available in the system for dilution; and 3) change the timing of diversions to avoid periods of poor water quality. All core measures that reduce the quantities of contaminants entering the aquatic system are included because those actions support the main theme. Equity actions are included to reduce impacts on water users who must make do with smaller supplies. The overall improvement in the quality of diverted and delivered water is in itself a benefit that helps to achieve equity.

Preliminary Alternative 110**Improve Water Quality with Land Use Management, Including Wetland and Riparian Management.**

Theme: Improve water quality by increasing instream management measures
Subtheme: Manage watershed land use to improve instream water quality
Approach: Using habitat (especially wetland) and enhancement practices

Solution Overview or Key Actions

This alternative includes the maximum of all core actions to manage land use to maintain or improve water quality, using wetland and riparian areas to help maintain instream water quality. The core actions that are designed to provide water quality benefits and those core actions that indirectly provide benefits are included at the maximum level.

Preliminary Alternative 111**Improve Water Quality with Land Use Management Using Watershed Best Management Practices**

Theme: Improve water quality by increasing instream management measures
Subtheme: Manage watershed land use to improve instream water quality
Approach: Using best watershed land use management practices.

Solution Overview or Key Actions

This alternative includes the maximum of all core actions to manage land use to maintain or improve water quality, using watershed management practices to help maintain instream water quality. The core actions that are designed to provide water quality benefits and those core actions that indirectly provide benefits are included at the maximum level.

Preliminary Alternative 112**Improve Water Quality for Delta Diversions Through the Use of Physical Improvements in Delta Waterways.**

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| <i>Theme:</i> | Improve water quality by increasing instream management measures. |
| <i>Subtheme:</i> | Improve water quality through the use of physical improvements in Delta waterways (e.g. changes in diversions locations, barriers and weirs, channel modifications, through-Delta conveyance improvements). |
| <i>Approach:</i> | Improve Delta diversion water quality. |

Solution Overview or Key Actions

Selected all actions to improve the water quality of Delta diversions through the use of physical improvements in the Delta waterways. Then implemented, at the maximum level, all core actions that result in improvement of Delta diversions as supported by the main theme. Then determined who would be hurt by implementing these actions and added actions to achieve equity.

Preliminary Alternative 113

Improve Water Quality for Delta Ecosystem Through the Use of Physical Improvements in Delta Waterways.

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|------------------|---|
| <i>Theme:</i> | Improve water quality by increasing instream management measures. |
| <i>Subtheme:</i> | Improve water quality through the use of physical improvements in Delta waterways (e.g. changes in diversions locations, barriers and weirs, channel modifications, through-Delta conveyance improvements). |
| <i>Approach:</i> | Improve Delta ecosystem water quality. |

Solution Overview or Key Actions

Selected all actions to improve the water quality of the Delta ecosystem through the use of physical improvements in the Delta waterways. Then implemented, at the maximum level, all core actions that result in improvement of Delta diversions as supported by the main theme. Then determined who would be hurt by implementing these actions and added actions to achieve equity.

Preliminary Alternative 114

Improve Habitat Quality and Quantity Through Conversion of Existing Land Uses.

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| <i>Theme:</i> | Improve habitat quality and quantity. |
| <i>Subtheme:</i> | Convert existing land uses |
| <i>Approach:</i> | Balance land use conversions with habitat creation to minimize economic impacts |

Solution Overview or Key Actions

Selected all actions to improve the quality and quantity of habitat in and upstream of the Delta by changing land uses. Also emphasized habitat improvement actions that did not require land use conversions. Actions that improved the quality and/or quantity of habitat were selected with the intent of balancing the extent of land use conversions that would be needed with improvements to existing land uses. Other actions were added to achieve equity for those stakeholders that may be adversely affected by key actions selected.

Preliminary Alternative 115

Improve Habitat Quality Without Converting Existing Land Use Patterns

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|---|--------------------------------------|
| <i>Theme:</i> | Improve habitat quality |
| <i>Subtheme:</i> | Minimize land use conversions |
| <i>Approach:</i> | Protect and enhance existing habitat |
| <u>Solution Overview or Key Actions</u> This alternative is designed to improve habitat quality ;without changing existing land use patterns. This would be accomplished through measures to protect existing habitat and to modify existing habitat to benefit more highly valued species. Habitat modifications would include revegetating denuded areas, replenishing spawning gravels, reducing obstacles to fish passage, removing contaminated sediments, creating shallow water habitat by filling areas of deep water, improving drainage of floodways to reduce fish-stranding hazards, and controlling exotic species. In addition, existing land use practices would be modified to improve habitat conditions. Modifications would be made to levee maintenance, gravel mining, and farming practices and to locations of water diversions. | |

| Preliminary Alternative 116 | |
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| Improve Habitat Quality and Quantity Through a Combination of Creating New Habitat by Converting Existing Land Uses and Preserving and Enhancing Existing Habitat | |
| <i>Theme:</i> | Improve habitat quality. |
| <i>Subtheme:</i> | Change land uses. |
| <i>Approach:</i> | Complement land use changes with improvements in existing land uses. |
| <u>Solution Overview or Key Actions</u> This alternative is designed to improve habitat quality and quantity through actions that combine changes in land uses with complementary improvements in existing land uses. For example, waterfowl forage would be increased by converting some agricultural lands to wetlands, while changing cropping and harvest practices on other lands. Similarly, the habitat value of floodways would be improved by retiring some farmlands and change farming practices on others. Other actions selected for controlling exotic species, improving fish passage conditions, revegetating and otherwise improving shoreline habitats, incorporating habitat objectives in management of watershed ground cover and groundwater recharge zones. In addition, all actions to improve habitat quality and quantity that require land use conversions (e.g., Alternative #114), and all actions to improve habitat quality by preserving and enhancing existing habitats (e.g. Alternative #115) are included in this alternative. | |

| Preliminary Alternative 117 | |
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| Improve Water Quality by Diluting Pollutants with Stored Water and Reduced Diversions, and Create Habitat by Restoring and Enhancing Existing Habitat Areas. | |
| <i>Theme:</i> | Improve water quality |
| <i>Subtheme:</i> | Balance dilution and nonpoint source discharge management |
| <i>Approach:</i> | Habitat rehabilitation/restoration/management |

Solution Overview or Key Actions

New shallow water habitat areas -create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing river banks and shallow areas, and by restoring/preserving channel islands.

New Upstream Habitats - restore a variety of Delta and upstream habitats by protecting and enhancing existing wetland, riparian, and wetland areas.

Dilution Flows - use a variety of actions, including modifying upstream reservoir operations, land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California to reallocate water supplies to be used for dilution.

Levee Upgrades - improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 118

Improve Water Quality by Diluting Pollutants with Stored Water and Water from Reduced Diversions and Create Habitat by Converting Existing Land Uses into Habitat Areas.

Theme: Improve water quality by dilution
Subtheme: Use stored water
Approach: Reduce diversions and convert land use to habitat

Solution Overview or Key Actions

Restore shallow water habitat—Create new areas of shallow water habitat in the Delta by subjecting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

Restore upstream habitat— Create a mosaic of habitat types upstream of the Delta at the minimum level of implementation.

Increase dilution flows— Use a variety of actions, including land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California to reallocate water supplies to be used for dilution.

Improve levee maintenance and stability— Improve levees to protect land uses and restored freshwater habitats.

Preliminary Alternative 119

Improve Water Quality by Diluting Pollutants with Stored Water and Reduced Diversions, and Create Habitat by Balancing the Preservation and Enhancement of Existing Habitats with the Creation of New Habitats by Converting Economic Land Uses.

Theme: Improve water quality by dilution
Subtheme: Use stored water and reduce diversions
Approach: Balance dilutions, use of storage, and reduced diversions with land use conversions

Solution Overview or Key Actions

Delta Shallow Water Habitat - create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing river banks and shallow areas, by restoring/preserving channel islands, and by converting existing leveed lands to tidal action.

Delta and Upstream Habitats - create a variety of habitat types upstream of and in the Delta, by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

Dilution Flows - use a variety of actions, including land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California to reallocate water supplies to be used for dilution.

Levee Upgrades - improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 120

Improve habitat and improve in-Delta and export water quality, primarily with physical facilities in the Delta, while maintaining existing land uses to the maximum degree possible

Theme: Combine the themes of improving water quality and habitat quality
Subtheme: Modify physical facilities in the Delta and maintain existing land uses
Approach: Improve water quality to meet ecosystem and export requirements with minimal impacts on existing land uses.

Solution Overview or Key Actions

This alternative improves water quality for in-Delta economic and ecological needs by using three types of actions that 1) serve to increase the quality and quantity of water available in the Delta, thereby decreasing the concentrations of contaminants; 2) alter the distribution and timing of flows in the Delta making more water available in the system for dilution of contaminants and beneficial use; and 3) change the locations and timing of diversions to avoid periods of poor water quality and reduce entrainment of high fish populations.

Preliminary Alternative 121

Enhance Habitat and Water Quality, Primarily by Modifying or Constructing Delta Physical Facilities and Converting Existing Land Uses, While Minimizing Adverse Impacts

Theme: Enhance habitat quality and water quality simultaneously
Subtheme: Convert existing land uses to habitat
Approach: Construct facilities, convert economic uses to habitat, and reduce nonpoint source discharges

Solution Overview or Key Actions

New shallow water habitat areas - Create new shallow water habitat by converting western Delta islands and diked wetlands into tidal wetlands, adding submerged berms to existing levees, filling selected deep areas, and reconstructing riverbanks. Aquatic habitat also would be constructed.

New and improved upstream and riparian habitats - Restore wetlands and riparian habitats in floodways to form ecological corridors. Restore Delta wetlands and riparian habitats by acquiring lands or easements, ensuring adequate water availability (including treated wastewaters), and replanting native species.

Construction and Improvement of Conveyance Facilities - Delta islands would be converted to a storage and conveyance system (the "chain-of-lakes" alternative) extending from the northern diversion to the export pumps. The flooded islands would be connected by a series of inverted siphons with pump stations added where additional head is needed.

Reduce Effects of Diversions - Reduce effects on Bay-Delta aquatic habitat quantity and quality by relocating and reducing in-Delta diversions, altering their timing and improving or constructing fish screens. The major benefit is achieved by relocating the export diversion from the current South-Delta site, -subject to reverse flows, to the north Delta or Sacramento River, where diversions can be better timed. Modify facilities and/or operations to vary remaining Delta channel flows, particularly the flow split between the Sacramento and Mokelumne systems, flows toward the pumps, and inflows into the San Joaquin River for the purposes of avoiding entrainment, improving aquatic habitat, diluting contaminants, and displacing waters of poor quality. Modify Delta and export diversions and increase export capacities

Managing Water Quality - Improve export and in-Delta water quality by diverting higher quality Sacramento River water and releasing it into channels at selected Delta locations. Limited releases could be made to rapidly respond to water quality degradation in the Delta (e.g. from saltwater intrusion) at times when there would be no interference with anadromous fish migrations. South Delta water quality is improved by releases, tide gates, barriers and salinity control structures. South Delta water quality is improved by tidal gates barriers, and salinity control structures. Retire agricultural land with drainage problems to eliminate large volumes and sources of salt loads reaching the Delta. Utilize existing evaporation ponds for storage of agricultural drainage and release it only during periods of high instream flows.

Island and Levee Maintenance and Stabilization - Reconstruct selected high value levees and those protecting the island transfer system to protect against failure mechanisms. Use levee setbacks wherever needed and feasible. Stabilize other islands with less expensive levee improvements, or use large-scale in-filling of the lowest areas with suitable blends of inorganic soil and compost, or clean dredged materials, to restore interior elevations.

Preliminary Alternative 122

Improve Delta Water Quality, Primarily by Modifying or Constructing Delta Physical Facilities, and Create Habitat by Restoring and Enhancing Existing Habitat Areas.

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| <i>Theme:</i> | Improve water quality |
| <i>Subtheme:</i> | Physical in-Delta improvements |
| <i>Approach:</i> | Facilities construction, habitat restoration and improvements |

Solution Overview or Key Actions

Delta Shallow Water Habitat - create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing river banks and shallow areas, by restoring/preserving channel islands, and by converting existing leveed lands to tidal action.

Delta and Upstream Habitats - create a variety of habitat types upstream of and in the Delta, by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

Dilution Flows - use a variety of actions, including land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California to reallocate water supplies to be used for dilution.

Levee Upgrades - improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 123

Managing Watersheds and Restoring Existing Habitat

Theme: Improve water quality by managing upstream watersheds
Subtheme: Create additional habitat
Approach: Restore and enhance upstream habitat areas

Solution Overview or Key Actions

Delta shallow water habitat - Create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing river banks and shallow areas, and by restoring/preserving channel islands.

Delta and Upstream Habitats - Restore a variety of Delta and upstream habitats by protecting and enhancing existing wetland, riparian, and wetland areas.

Watershed Management - Protect water quality by managing mine drainage and managing land uses within upstream watersheds.

Levee Upgrades - Improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 124

Improve Water Quality by Managing Upstream Watersheds and Create Habitat by Converting Lands Currently in Economic Uses into Habitat Areas .

Theme: Improve habitat and water quality
Subtheme: Convert existing lands
Approach: Manage watershed land use

Solution Overview or Key Actions

Delta Shallow Water Habitat - create new areas of shallow water habitat in the Delta by converting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

Delta and Upstream Habitats - create a mosaic of habitat types upstream of the Delta, at the minimum level of implementation.

Watershed Management - protect water quality by managing mine drainage and managing land uses within upstream watersheds.

Levee Upgrades - improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 125

Improve Water Quality by Managing Upstream Watersheds and Create Habitat by Balancing the Preservation and Enhancement of Existing Habitats with the Creation of New Habitats Through the Conversion of Land Currently in Economic Uses to Habitat Areas.

Theme: Improve water quality
Subtheme: Watershed management
Approach: Habitat restoration and enhancement

Solution Overview or Key Actions

Delta Shallow Water Habitat - create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing river banks and shallow areas, restoring and preserving channel islands, and converting existing leveed lands to tidal action.

Delta and Upstream Habitats - create a variety of habitat types upstream of and in the Delta, by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

Watershed Management - protect water quality by managing mine drainage and managing land uses within upstream watersheds.

Levee Upgrades - improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 126

Improve Water Quality Through the Management of Agricultural, Municipal, Industrial, and Mine Discharges and Create Habitat by Restoring and Enhancing Existing Habitat Areas.

Theme: Improve water quality
Subtheme: Create and restore, and enhance existing habitat
Approach: Manage agricultural, municipal, industrial, and mine discharges

Solution Overview or Key Actions

Delta Shallow Water Habitat - Create new areas of shallow water habitat in the Delta by reconstructing levees, riverbanks, and shallow water habitat areas and by restoring/preserving channel islands.

Delta and Upstream Habitats - Restore a variety of Delta and upstream habitats by protecting and enhancing existing aquatic, wetland, and riparian areas.

Reclamation - Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

Levee Upgrades - Improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 127

Improve Water Quality by Managing Discharges and Create Habitat by Converting Economic Land Uses into Habitat Areas .

Theme: Improve water quality
Subtheme: Convert economic land uses to habitat
Approach: Manage discharges (overall)

Solution Overview or Key Actions

New Shallow Water Habitat Areas - Create new areas of shallow water habitat in the Delta by converting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

New Upstream Habitats - Create a mosaic of habitat types upstream of the Delta at the minimum level of implementation.

Reclamation - Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

Levee Upgrades - Improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 128

Improve Water Quality by Managing Discharges and Create Habitat by Balancing the Preservation and Enhancement of Existing Habitats with the Creation of New Habitats by Converting Economic Land Uses.

Theme: Improve water quality
Subtheme: Manage nonpoint source discharges
Approach: Convert economically used land to habitat

Solution Overview or Key Actions

Delta Shallow Water Habitat - Create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing riverbanks and shallow water habitat areas, restoring/preserving channel islands, and converting existing leveed lands to tidal action.

Delta and Upstream Habitats - Create a variety of habitat types upstream of and in the Delta by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

Reclamation - Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

Levee Upgrades - Improve levees around important economic land uses and restored freshwater habitats.

Preliminary Alternative 201

Reduce Competition for Water During Critical Periods by Reducing Demand

Theme: Demand reduction

Subtheme: In export area only

Approach: Conservation/reclamation, water marketing, land use planning

Solution Overview or Key Actions

This alternative was intended to minimize future water needs in the export area to the maximum extent practicable by aggressive demand management, water marketing, and water pricing. It was felt that the combination of demand management actions and more efficient water marketing actions are synergistic and will lead to a more efficient utilization of the existing resource. This alternative emphasizes conservation, reclamation, pricing, water transfers, and land use planning and conversion.

Preliminary Alternative 202

Reduce Competition for Water During Critical Periods by Reducing Demand

Theme: Demand reduction

Sub theme: In and upstream of Delta only

Approach: Conservation/reclamation and water marketing

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by reducing agricultural and urban demand. It combines demand management and more efficient water marketing. This alternative emphasizes conservation, reclamation, pricing, water transfers, and land use planning and conversion. It may lead to reduced diversions in and upstream of the Delta and, may necessitate reoperational actions. This alternative would encourage actions to facilitate water marketing and a market-driven pricing structure. Improved land use planning based on water availability and actions that would encourage land retirement and fallowing during drought periods.

| Preliminary Alternative 203 | |
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| Reduce Competition for Water During Critical Periods by Reducing Demand | |
| <i>Theme:</i> | Demand reduction |
| <i>Subtheme:</i> | In export area and in and upstream of Delta |
| <i>Approach:</i> | Conservation/reclamation, water marketing, land use planning |
| <u>Solution Overview or Key Actions</u> This alternative is intended to increase the supply and reliability of Delta exports by reducing agricultural, industrial, and municipal demand in the export area and in and upstream of the Delta. It combines demand management, water marketing, and land use planning actions. It emphasizes actions such as conservation, reclamation, pricing, water transfers, and land use planning and conversion. This alternative recognizes that currently there are institutional and regulatory impediments that need to be overcome to achieve reliable transfers between willing sellers in and upstream of the Delta and willing buyers. It is based on aggressive implementation of actions that tend toward better use of existing supplies. | |

| Preliminary Alternative 204 | |
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| Adaptive Management of Delta Outflow for Transport and Estuarine Habitat Conditions | |
| <i>Theme:</i> | Reduce water requirements for transport and habitat needs |
| <i>Subtheme:</i> | Minimize surplus Delta outflows beyond transport and habitat needs |
| <i>Approach:</i> | Adaptive management with real-time salinity and fish monitoring |
| <u>Solution Overview or Key Actions</u> This alternative is intended to achieve substantial improvement in transport and estuarine habitat conditions and the survival of juvenile fish species feeding and rearing in the estuarine habitat. Restoration of shallow and wetland habitat in the vicinity of the confluence of the Sacramento and San Joaquin Rivers (some agricultural land conversion) would be used to improve the estuarine habitat. This alternative emphasizes actions that will improve the suitable estuarine habitat conditions (salinity, transport and entrainment reductions) with reduced Delta outflow requirements. These savings in releases from storage and outflow requirements would then become available for export during times when entrainment effects would be minimized. Cooling towers for the PG&E Delta power plants should be constructed to reduce the entrainment effects in the expanded estuarine habitat. Fish barriers at the Delta Cross Channel, Georgiana Slough, and Threemile Slough should be included to reduce the mortality of migrating salmon and other anadromous species. Pulse flows would be used to transport riverine and Delta spawning larvae into the estuarine entrapment zone used for rearing. | |

| Preliminary Alternative 205 | |
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| Reduce Competition for Water During Critical Periods by Reducing Demand | |
| <i>Theme:</i> | Reduce requirements for instream flow and transport management. |
| <i>Subtheme:</i> | Minimize releases beyond riverine habitat and restoration needs. |
| <i>Approach:</i> | Adaptive management with real-time temperature and fish monitoring. |

Solution Overview or Key Actions

This alternative is intended to achieve substantial improvement in riverine habitat conditions and the survival of spawning and rearing juvenile fish by restoring channel and riparian habitat below the major tributary storage reservoirs. This alternative emphasizes actions that will improve the suitable habitat conditions (temperature, gravel, transport, entrainment reductions) with reduced reservoir release requirements. These savings in releases from storage would then become available for export during times when pumping capacity was available when entrainment effects would be minimized. Major river diversions should be relocated to upstream of the anadromous habitat area (e.g. canal from Keswick to replace Tehama-Colusa and Glenn-Colusa Irrigation District's intakes). Channel and riparian restoration activities would be used to improve the riverine habitat.

Preliminary Alternative 206**Adaptive Management of Delta Outflow and Instream Flow Releases**

Theme: Reduce water requirements for riverine and estuarine habitat management.
Subtheme: Minimize reservoir releases and Delta outflows beyond habitat needs.
Approach: Adaptive management with real-time temperature, salinity and fish monitoring.

Solution Overview or Key Actions

This alternative is intended to achieve substantial improvement in both riverine and estuarine habitat conditions and increase the survival of fish spawning and rearing in those habitats. Channel and riparian restoration activities would be used to improve the riverine habitat. Restoration of shallow and wetland habitats in the vicinity of the confluence of the Sacramento and San Joaquin Rivers (some agricultural land conversion) would be used to improve the estuarine habitat. This alternative also emphasizes actions that will improve the suitable riverine habitat conditions (temperature, gravel, transport, entrainment reductions) with reduced reservoir release requirements. These savings in releases from storage and outflow requirements would then become available for export during times when entrainment effects would be minimized. Major river diversions should be relocated to upstream of the riverine habitat area. Cooling towers for the PG&E Delta power plants should be constructed to reduce the entrainment effects in the expanded estuarine habitat. Fish barriers at the Delta Cross Channel, Georgiana Slough, and Threemile Slough should be included to reduce the mortality of migrating salmon and other anadromous species. Pulse flows would be used to transport riverine and Delta spawning larvae into the estuarine entrapment zone used for rearing.

Preliminary Alternative 207**Reduce Competition for Delta Supplies by Expanding Off-stream Storage in Export Areas**

Theme: Reduce competition for water during critical periods by increasing availability.
Subtheme: Increase storage in the export areas.
Approach: Develop new off-stream storage facilities.

Solution Overview or Key Actions

This alternative is intended to reduce the competition of water supplies during critical periods by increasing the amount of available storage in the export areas. The availability of additional off-stream storage would be integrated with SWP/CVP diversion patterns to capture a greater portion of flood/winter flows. Captured flows would be stored for release during periods of high competition for water in the Delta, thereby reducing the demand from the Delta during these periods. Beyond the core actions in this category, additional actions would be selected to (1) Increase off-stream storage in the export areas (on the order of 500 TAF), and implement long-term planning for drought contingencies above core level implementation.

| Preliminary Alternative 208 | |
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| Reduce Competition for Delta Supplies by Increasing On-stream Storage Capacities Upstream of the Delta | |
| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage upstream of the Delta. |
| <i>Approach:</i> | Develop additional on-stream storage capacity. |
| <u>Solution Overview or Key Actions</u> <p>This alternative is intended to reduce the competition of water supplies during critical periods by increasing the amount of storage and supply in the area upstream of the Delta. The development of additional on-stream storage capacity coupled with reoperation of existing storage facilities would capture a greater portion of flood/winter flows and reduces the losses associated with flood control releases. Flows stored in new or expanded on-stream reservoirs upstream of the Delta would be release during periods of high competition for water in the Delta, thereby increasing the available supply and reducing competition during these periods. Beyond the core actions in this category, actions would be selected to expand on-stream storage capacity in areas upstream of the Delta, and to modify operations of reservoirs upstream of the Delta. The effect of these actions would be to increase the yield of watersheds upstream of the Delta. Core actions related to long-term planning for drought contingencies and improved coordination of water management would be would be implemented at a higher level than that proposed at the core level. Water supply reliability is the focus of this alternative. Reliability is improved through the development of additional on-stream storage upstream of the Delta. The increase in upstream storage would enable the capture of currently unregulated flows and a reduction in the loss of water released for flood control measures. The yield generated from such storage would be available for release during periods of high competition in the Delta, thereby reducing competition during these critical periods.</p> | |

| Preliminary Alternative 209 | |
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| Reduce Competition for Delta Supplies by Converting Select Delta Islands to Storage Facilities | |
| <i>Theme:</i> | Reduce competition for water during critical periods by increasing availability. |
| <i>Subtheme:</i> | Increase storage within the Delta. |
| <i>Approach:</i> | Convert select Delta islands to storage facilities. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by developing storage within the Delta through conversion of selected islands to storage facilities. These island storage facilities would capture excess flows in the Delta and release them for environmental or supply needs during periods when competition is high for other Delta sources. An in-Delta storage facility operated in such a manner would reduce the competition of Delta water supplies and ensure a greater level of reliability for export water. Beyond the core actions in this category, actions would be selected to develop storage capacity within the Delta, and to modify operations of reservoirs upstream of the Delta. The effect of these actions would be to capture excess flows in the Delta. Upstream reservoir operations would be altered to coordinate with releases from Delta storage facilities for export. Core actions related to long-term planning for drought contingencies and improved coordination of water management would be implemented at a higher level than that proposed at the core level. Water supply reliability is the focus of this alternative. Reliability is improved through the development in-Delta storage. In-Delta storage would be operated to capture excess Delta flows and generate new supplies to ensure the reliability of export and environmental water in the Delta. The focus of this in-Delta facility is to reduce competition for water during critical periods.

Preliminary Alternative 210

Reduce Competition for Water Through Enhanced Utilization of Conjunctive Use Programs

Theme: Reduce competition during critical periods by increasing supply availability.
Subtheme: Increase ground and surface water conjunctive use storage.
Approach: Increase groundwater storage north of the Delta for use during periods of high competition.

Solution Overview or Key Actions

This alternative is intended to reduce the competition for Delta water supplies during critical periods by increasing the conjunctive use of groundwater and surface water supplies. This alternative would require increased diversion capacities at selected locations to divert surplus and flood flows into groundwater storage. The stored groundwater would be pumped during high competition periods and an equal amount of water would not be diverted from north of the Delta streams, thus increasing overall available Delta supply. The additional volume of water available to the Delta would increase the reliability of overall Delta water supply during critical periods.

Preliminary Alternative 211

Reduce Competition for Delta Supplies by Increasing Storage Capacities Throughout the System

Theme: Reduce competition during critical periods by increasing supply availability.
Subtheme: Increase storage in upstream and export areas and within the Delta.
Approach: Develop off-stream storage in the export area, on-stream storage upstream of the Delta, and Delta island storage within the Delta.

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods as well as increase the reliability of water supplies. Storage facilities would be developed in the export and upstream areas and within the Delta. These facilities would be operated to maximize supply reliability for Delta exports. While these facilities could provide water for environmental purposes, those benefits are not considered as part of this alternative. Additional Delta export management actions to modify export criteria are included in this alternative. Beyond the core actions in this category, actions would be selected to (1) develop new or expanded off-stream storage capacity in export areas, (2) expand on-stream storage capacity upstream of the Delta, (3) develop storage capacity within the Delta, and modify operations of reservoirs upstream of the Delta. The effect of these actions would be to capture unregulated flows in the Delta and upstream watersheds. Upstream reservoir operations would be altered to coordinate with releases from Delta storage facilities for export.

Preliminary Alternative 212**Reduce Competition During Critical Periods by Increasing Supply**

Theme: Increase supply
Subtheme: Increase efficiency of water movement through and/or around the Delta
Approach: Relocate and redesign export facilities.

Solution Overview or Key Actions

Currently, the diversions at the existing SWP and CVP export facilities are significantly constrained by environmental considerations such that the regulated diversions are often well below the physical capacities of the export pumps. This alternative is intended to relocate and/or redesign the export facilities in order to relax the current environmental restrictions on diversion magnitude and timing. By taking advantage of this "diversion opportunity," additional supplies would be made available for export. Actions in this alternative include relocating and redesigning the export diversion facilities such that diversion impacts in water transport, water quality, and fisheries are significantly reduced. Additional actions would include relocating the diversions to less sensitive locations (e.g., Old River), increasing the size of the forebays, and installing state-of-the-art fish screens and barriers. The principal thrust of this alternative is to enhance water supply reliability and water quality by relocating and redesigning the export facilities such that entrainment and "reverse flow" effects would be substantially mitigated.

Preliminary Alternative 213**Reduce Competition During Critical Periods by Increasing Supply**

Theme: Increase supply
Subtheme: Increase efficiency of water movement through and/or around the Delta
Approach: Develop east side isolated transfer/conveyance facility.

Solution Overview or Key Actions

This alternative is intended to increase the reliability and water quality of Delta exports by constructing an eastside isolated transfer facility between the Sacramento River in the north Delta and Clifton Court Forebay. It is assumed that by moving the diversion from the south Delta to the Sacramento River, the current regulatory export pumping restrictions will be significantly relaxed such that the full physical capacity of the export pumps will be available to be utilized. In this alternative, the capacity of the transfer facility is designed to be consistent with the pumping capacities of the SWP and CVP export facilities. Actions in this alternative include moving the current location of the diversion facilities to locations on the Sacramento River. The principal thrust of this alternative is to enhance water supply reliability by constructing a dedicated isolated transfer facility that would convey water around the Delta from the Sacramento River.

Preliminary Alternative 214**Reduce Competition During Critical Periods by Increasing Supply Availability**

Theme: Increase supply
Subtheme: Develop a combination storage/conveyance facility through the Delta
Approach: "Chain of lakes" concept

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by developing a water supply storage/conveyance system in the Delta. The system would consist of a series of flooded Delta islands linked by siphons, existing channels, or new channels (constructed across existing islands) leading from the Sacramento River to Clifton Court Forebay. The conveyance capacity of the system would be consistent with the present physical pumping capacities of the CVP and SWP export pumping facilities. The storage capacity of the system would be driven by which islands are chosen to be flooded and levee stability considerations. By moving the diversion facilities, this alternative would likely relax the current diversion restrictions, and provide more flexibility in the magnitude and timing of diversions. The additional storage would also facilitate high flow diversions during specific storm events which then could be utilized for export diversions (or environmental outflow) during critical environmental periods. The principal thrust of this alternative is to enhance water supply reliability by constructing an in-Delta storage/conveyance system whose primary purpose would be water supply, but may also have water quality-related benefits.

Preliminary Alternative 215**Reduce Competition During Critical Periods by Increasing Supply Availability**

Theme: Increase supply
Subtheme: Increase efficiency of water movement through or around the Delta
Approach: Increase export pumping capacity

Solution Overview or Key Actions

This alternative is intended to increase the reliability of Delta exports by increasing the through-Delta conveyance capacity, including channel capacity, forebay capacity, and export pumping capacity. Such additional capacity would provide the opportunity for increasing exports during high flow periods when entrainment effects would be minimized and water quality would be relatively good. This alternative would also likely include additional storage south of the Delta in order to take full advantage of the increased conveyance capacity. This alternative includes actions that will potentially decrease diversion effects at the export facilities by enlarging the forebay and by being able to pump during more selective periods (high tide periods and high Delta-outflow periods). The principal thrust of this alternative is to enhance water supply reliability and improve water quality by increasing the capacity of the Delta channel system and export facilities. This will result in the ability to export additional (and possibly higher quality) water during high flow events and/or during high tide; which then could be stored south of the Delta for critical and other periods.

Preliminary Alternative 216**Reduce Competition for Water During Critical Periods by Increasing Supply Availability**

Theme: Increase supply
Subtheme: Reoperate existing reservoirs to increase yield
Approach: Provide additional downstream flood protection, thereby relaxing flood protection constraints on reservoir operations

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by developing additional flood protection downstream of on-line reservoirs that would facilitate reoperation of the reservoirs with more emphasis on water supply. The premise of this alternative is that currently the threat of downstream flooding constrains reservoir operators in terms of managing release flows and storage. Relaxing of such constraints could benefit water supply by providing more reservoir storage dedicated to water supply. This alternative therefore requires the construction of additional downstream flood mitigation features, such as floodways, larger channel capacities, and/or set-back levees. The principal thrust of this alternative is to enhance water supply reliability by constructing additional downstream flood protection facilities that would allow reservoirs to be operated with less flood control constraints and more emphasis on water supply. This alternative would potentially provide for additional or enhanced habitat as part of constructing additional flood control facilities.

Preliminary Alternative 217**Reduce Competition During Critical Periods by Reducing Demand**

Theme: Reduce competition for water during critical periods by demand reduction
Subtheme: Demand reduction in export area and in and upstream of Delta and facilitated conveyance
Approach: Conservation/reclamation, water marketing, land use planning coupled with construction of isolated east side transfer facility to increase ability to convey conserved water and to facilitate north to south water transfers.

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by reducing demand, improving the water market and providing a better means of conveying conserved or marketed water to the export facilities. This alternative combines demand management actions, water marketing actions, and land use planning actions as these are synergistic and will lead to a more efficient utilization of the existing resource. This alternative therefore emphasizes actions such as conservation, reclamation, water pricing, water transfers, and land use planning and conversion. This alternative recognizes that Delta conveyance and regulatory requirements constrains transfers between willing sellers in and upstream of the Delta and willing buyers in the export area. In order to help facilitate such transfers, this alternative also includes construction of an isolated east side transfer facility from the Sacramento River to Clifton Court Forebay. This isolated facility would also be able to convey additional supplies created from conservation and reclamation. water would supplement supplies for potable and nonpotable uses, including irrigation. To increase the options to water users, this alternative would encourage actions to facilitate water marketing and a market-driven pricing structure. Improved land use planning based on water availability and actions that would encourage land retirement and fallowing during drought periods would be undertaken under this option. A second thrust of this alternative is to enhance water supply predictability by improved conservation/reclamation of water in and upstream of the Delta and the construction of an isolated east side transfer facility that would facilitate north to south transfers and the conveyance of conserved water through the Delta. Conservation would be implemented by agricultural, industrial, and municipal users. Reclamation of municipal waste water and agricultural drainage water would supplement supplies for potable and nonpotable uses, including irrigation. To increase the options to water users, this alternative would encourage actions to facilitate water marketing and a market-driven pricing structure. Improved land use planning based on water availability and actions that would encourage land retirement and fallowing during drought periods would be undertaken under this option. Construction of an isolated transfer facility with a modern diversion on the Sacramento River would significantly relax the environmental constraints on export pumping and would permit a more flexible pumping schedule that could take better advantage of unregulated flows.

Preliminary Alternative 218

Reduce Competition for Water During Critical Periods by Reducing Demand

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| <i>Theme:</i> | Reduce competition during critical periods through demand reduction |
| <i>Subtheme:</i> | Reduce demand north and south of the Delta and provide for storage in the Delta |
| <i>Approach:</i> | Conservation/reclamation, water marketing, land use planning and convert Delta islands for storage |

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by demand reduction actions in the export area that translate into reduced future demands on Delta supplies, and demand reduction measures in and upstream of the Delta that translate into increased future supplies to the Delta. This alternative combines demand management actions, water marketing actions, and land use planning actions as these are synergistic and will lead to a more efficient utilization of the existing resource. This alternative therefore emphasizes actions such as conservation, reclamation, pricing, water transfers, and land use planning and conversion. This alternative recognizes that current regulatory restriction on export pumping are a major impediment to conducting reliable water marketing and transfers between willing sellers north of the Delta and willing buyers in the export area. In order to facilitate such transfers, this alternative includes converting selected Delta Islands for water supply storage and constructing an isolated conveyance facility between these islands and the export facilities, thereby avoiding the current environmental restrictions on export diversions. Such storage would also be utilized for conserved water. To increase the options to water users, this alternative would encourage actions to facilitate water marketing and a market-driven pricing structure. Improved land use planning based on water availability and actions that would encourage land retirement and fallowing during drought periods would be undertaken under this option. The second thrust of this alternative is to enhance water supply predictability by improved utilization and reuse of water in and upstream of the Delta and the facilitation of water transfers between north and south users through the construction of in-Delta storage and an isolated conveyance facility between this storage and the export facilities. Water saved by conservation and water available for transfers could be stored in the Delta and exported reliably without the current environmental restrictions on export diversions. This alternative would increase water supply reliability by reducing demand in the export area and increasing supply in the Delta by demand reduction in and upstream of the Delta. Water conserved and water available for north-to-south transfers would be stored in-Delta and pumped to the export facilities in an isolated conveyance system that would not fall under the current export diversions caps.

Preliminary Alternative 219

Reduce Competition for Water During Critical Period by Reducing Demand

Theme: Demand reduction
Subtheme: Reduce demand in export area and in and upstream of Delta and increase storage upstream of Delta
Approach: Water developed through conservation in the Delta would be available for direct export. Water developed upstream of the Delta would be stored in surface and/or groundwater storage to facilitate export during critical periods.

Solution Overview or Key Actions

This alternative is intended to increase the supply and reliability of Delta exports by reducing Delta demand in the export area and by increasing Delta supplies by demand reduction in and upstream of the Delta. Increases in Delta supplies through conservation would be managed for exports and could include surface and groundwater storage to maximize the conservation and reclamation potential. This alternative emphasizes actions such as conservation, reclamation, pricing, water transfers, land use planning and conversion, and storage upstream of the Delta. One thrust of this alternative is to reduce export reliance by improved utilization and reuse of water in the export area. Many of the actions in this alternative are core actions which would be implemented at the maximum level. Conservation would be implemented by agricultural, industrial, and municipal users. Reclamation of municipal waste water and agricultural drainage water would supplement supplies for potable and nonpotable uses, including irrigation. To increase the options to water users, this alternative would encourage actions to facilitate water marketing and a market-driven pricing structure. Improved land use planning based on water availability and actions that would encourage land retirement and fallowing during drought periods would be undertaken under this option.

| Preliminary Alternative 220 | |
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| Delta Outflow and Instream Flow Management with Delta Storage | |
| <i>Theme:</i> | Reduce water requirements for riverine and estuarine habitat management. |
| <i>Subtheme:</i> | Minimize reservoir releases and Delta outflows beyond habitat needs. |
| <i>Approach:</i> | Adaptive management of reservoir releases, outflow, exports, and in-Delta storage based on real-time salinity and fish monitoring. |
| <u>Solution Overview or Key Actions</u> This alternative is intended to achieve substantial improvement in both riverine and estuarine habitat conditions and to increase the survival of fish spawning and rearing in the riverine and estuarine habitats. Channel and riparian restoration activities would be used to improve the riverine habitat. Restoration of shallow and wetland habitat in the vicinity of the confluence of the Sacramento and San Joaquin Rivers (some agricultural land conversion) would be used to improve the estuarine habitat. This alternative also emphasizes actions that will improve the suitable riverine habitat conditions (temperature, gravel, transport, entrainment reductions) with reduced reservoir release requirements. These savings in releases from storage and outflow requirements would then become available for export during times when entrainment effects would be minimized. Major river diversions should be relocated to upstream of the riverine habitat area. Cooling towers for the PG&E Delta power plants should be constructed to reduce the entrainment effects in the expanded estuarine habitat. Fish barriers at the Delta Cross Channel, Georgiana Slough, and Threemile Slough should be included to reduce the mortality of migrating salmon and other anadromous species. Pulse flows would be used to transport riverine and Delta spawning larvae into the estuarine entrapment zone used for rearing. In-Delta storage is used to capture high Delta inflows (greater than export capacity and Delta outflow requirements). Delta storage could then be released for subsequent adaptive management of Delta outflow or for increased exports during periods with reduced entrainment effects. | |

| Preliminary Alternative 221 | |
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| Delta Outflow and Instream Flow Management with Relocated Export Intakes | |
| <i>Theme:</i> | Reduce water requirements for riverine and estuarine habitat management |
| <i>Subtheme:</i> | Minimize reservoir releases and Delta outflows beyond habitat needs. |
| <i>Approach:</i> | Adaptive management of reservoir releases, outflow, and exports based on real-time salinity and fish monitoring with relocated export intakes. |

Solution Overview or Key Actions

This alternative is intended to achieve substantial improvement in both riverine and estuarine habitat conditions and to increase the survival of fish spawning and rearing in the riverine and estuarine habitats. Channel and riparian restoration activities would be used to improve the riverine habitat. Restoration of shallow and wetland habitat in the vicinity of the confluence of the Sacramento and San Joaquin Rivers (some agricultural land conversion) would be used to improve the estuarine habitat. This alternative also emphasizes actions that will improve the suitable riverine habitat conditions (temperature, gravel, transport, entrainment reductions) with reduced reservoir release requirements. This alternative also emphasizes actions that will improve the suitable estuarine habitat conditions (salinity, transport and entrainment reductions) with reduced Delta outflow requirements. These savings in releases from storage and outflow requirements would then become available for export during times when entrainment effects would be minimized. Relocated Delta export intakes with best available screening facilities would substantially increase the opportunities for diversion of Sacramento River inflows that are not required for estuarine habitat and salinity control. Major river diversions should be relocated to upstream of the riverine habitat area. Cooling towers for the PG&E Delta power plants should be constructed to reduce the entrainment effects in the expanded estuarine habitat. Fish barriers at the Delta Cross Channel, Georgiana Slough, and Threemile Slough should be included to reduce the mortality of migrating salmon and other anadromous species. Pulse flows would be used to transport riverine and Delta spawning larvae into the estuarine entrapment zone used for rearing.

Preliminary Alternative 222

Delta Outflow and Instream Flow Management with Delta Storage and Relocated Export Intakes

Theme: Reduce water requirements for riverine and estuarine habitat management
Subtheme: Minimize reservoir releases and Delta outflows beyond habitat needs.
Approach: Adaptive management of reservoir releases, outflow, Delta storage, and exports based on real-time salinity and fish monitoring with relocated export intakes.

Solution Overview or Key Actions

This alternative is intended to achieve substantial improvement in both riverine and estuarine habitat conditions and to increase the survival of fish spawning and rearing in the riverine and estuarine habitats. Channel and riparian restoration activities would be used to improve the riverine habitat. Restoration of shallow and wetland habitat in the vicinity of the confluence of the Sacramento and San Joaquin Rivers (some agricultural land conversion) would be used to improve the estuarine habitat. This alternative also emphasizes actions that will improve the suitable riverine habitat conditions (temperature, gravel, transport, entrainment reductions) with reduced reservoir release requirements. This alternative also emphasizes actions that will improve the suitable estuarine habitat conditions (salinity, transport and entrainment reductions) with reduced Delta outflow requirements. These savings in releases from storage and outflow requirements would then become available for export during times when entrainment effects would be minimized. Relocated Delta export intakes with best available screening facilities would substantially increase the opportunities for diversion of Sacramento River inflows that are not required for estuarine habitat and salinity control. Major river diversions should be relocated to upstream of the riverine habitat area. Cooling towers for the PG&E Delta power plants should be constructed to reduce the entrainment effects in the expanded estuarine habitat. Fish barriers at the Delta Cross Channel, Georgiana Slough, and Threemile Slough should be included to reduce the mortality of migrating salmon and other anadromous species. Pulse flows would be used to transport riverine and Delta spawning larvae into the estuarine entrapment zone used for rearing. In-Delta storage is used to capture high Delta inflows (greater than export capacity and Delta outflow requirements). Delta storage could then be released for subsequent adaptive management of Delta outflow for estuarine habitat management and salinity control.

| Preliminary Alternative 223 | |
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| Reduce Competition for Delta Supplies by Expanding Off stream Storage and Improving Through-Delta Conveyance | |
| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage in the export area and develop an isolated conveyance facility. |
| <i>Approach:</i> | Develop new off-stream storage on the west side of San Joaquin Valley. |
| <u>Solution Overview or Key Actions</u> <p>This alternative is intended to reduce the competition of water supplies during critical periods by increasing the amount of available storage and increasing the ability to convey water to export facilities. Additional off-stream storage along the west side of the San Joaquin Valley and increased opportunities to deliver water to the export facilities would allow greater opportunities to capture a larger portion of flood/winter flows and manage captured flows for delivery to exporters. The isolated conveyance facility would be developed with the capacity to provide export water and environmental releases. In addition to core actions, additional actions included in this alternative include Delta export management actions to modify export criteria, and to relocate and consolidate pumping facilities away from key habitats. Beyond the core actions in this category, actions would be selected to (1) increase off-stream storage in the export areas (+500 TAF), implement long-term planning for drought contingencies above core level implementation, and construct an isolated conveyance facility including siphons between Delta channels. Water supply reliability is the focus of this alternative. The reliability is improved through the development of additional off-stream storage which would enable the capture of flood/winter flows which are currently not diverted from the Delta due to a lack of storage availability. The additional storage would provide greater flexibility in managing export diversions and deliveries. In addition, opportunities to export water from the Delta will be increased with the development of an isolated transfer facility.</p> | |

| Preliminary Alternative 224 | |
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| Reduce Competition for Delta Supplies by Expanding Off-Stream Storage and Increasing the Delta Export Capacity | |
| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage in the export area and increase Delta export capacity. |
| <i>Approach:</i> | Develop new off-stream storage on the west side of the San Joaquin Valley. Increase the pumping and conveyance capacities of Delta export facilities. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by increasing the amount of available storage and increase the capacity to export flows from the Delta. Additional off-stream storage along the east side of the San Joaquin Valley and increased capacities to divert water from the Delta would allow larger opportunities to capture a greater portion of flood/winter flows and manage captured flows for delivery to exporters. In addition to core actions, Delta export management actions would include (1) modification of export criteria, (2) modification of diversion timing for in-Delta diversions, and (3) enlargement of export pumping and conveyance capacities to generate yield and reduce impacts. Beyond the core actions in this category, the major actions selected for this alternative are to (1) increase off-stream storage in the export areas (+500 TAF), (2) store groundwater south of the Delta for long-term drought supply augmentation, and (3) implement long-term planning for drought contingencies above core level implementation. Water supply reliability is the focus of this alternative. The reliability is improved through the development of additional off-stream storage south of the Delta and increased pumping and conveyance capacities at the export facilities. This alternative would allow for a greater portion of the flood/winter flows to be diverted from the Delta. The additional storage would also provide greater flexibility in managing export diversions and deliveries. The ability to divert and store excess Delta flows, when they occur, would increase the yield available for export and decrease competition for existing supplies.

Preliminary Alternative 225**Reduce Competition for Delta Supplies by Expanding Off-Stream Storage and Increasing In-Delta Storage Capabilities**

Theme: Reduce competition for water during critical periods by increasing supply availability.
Subtheme: Increase storage in the export area and develop storage facilities within the Delta.
Approach: Develop new off-stream storage on the west side of San Joaquin Valley.
Develop storage within the Delta through conversion of Delta islands.

Solution Overview or Key Actions

The alternative is intended to reduce the competition for water supplies during critical periods by increasing the storage capabilities along the east side of the San Joaquin Valley and within the Delta. Additional storage south of the Delta would provide storage capacity to divert winter/flood flows to the available export capacity. Currently the diversion of winter/flood flows is limited by storage capacity south of the Delta. In-Delta storage would allow an additional increment of winter/flood flows to be captured and exported when capacity is available. In-Delta storage could provide operational flexibility for transfers through the Delta. These two projects would increase the yield from the Delta, thereby reducing the competition for supplies during critical periods. Beyond the core actions in this category, actions would be selected to (1) increase off-stream storage in the export areas (+500 TAF), (2) construct in-Delta storage facilities (Bacon Island and Webb Tract), and (3) establish conjunctive-use programs for long-term drought contingency south of the Delta. Water supply reliability is the focus of this alternative. The reliability is improved through the development of additional storage which would enable the diversion and capture of flood/winter flows which are currently undiverted due to lack of storage availability. The additional storage would provide greater flexibility in managing export diversions and deliveries.

Preliminary Alternative 226**Reduce Competition for Delta Supplies by Expanding On-Stream Storage and Improving Through Delta Conveyance.**

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| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage upstream of the Delta and develop an isolated conveyance facility. |
| <i>Approach:</i> | Develop new on-stream storage on the east side of the Sacramento Valley. Develop an east side Delta conveyance facility for export water. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by increasing the amount of available storage and increasing the ability to convey water to export facilities. Additional on-stream storage along the east side of the Sacramento Valley would provide greater opportunities to increase yields from the east side watersheds and reduce winter/flood flow losses. An isolated conveyance facility would increase the efficiency of water deliveries to the export facilities. The isolated conveyance facility would be developed with the capacity to provide export water as well as environmental releases to the south Delta channels.

Preliminary Alternative 227

Reduce Competition for Delta Supplies by Expanding Off-Stream Storage and Improving Through-Delta Conveyance

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| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage upstream of the Delta and develop an isolated conveyance facility. |
| <i>Approach:</i> | Develop new off-stream storage on the west side of the Sacramento Valley. Develop a west-side Delta conveyance facility for west-side irrigation deliveries. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by increasing the amount of available off-stream storage and increase the efficiency of deliveries to west-side Sacramento Valley irrigators. Additional off-stream storage along the west-side of the Sacramento Valley would provide opportunities to capture winter and flood flows from the Sacramento River and west-side tributaries. A large west-side isolated conveyance facility would connect the upper Sacramento River (above Keswick) to Off stream reservoirs and delivery points along the west-side of the Sacramento River. The west-side conveyance facility could also be connected to the Delta and export facilities if expanded.

Preliminary Alternative 228

Reduce Competition for Delta Supplies by Expanding Storage in All Areas and Improving Through Delta Conveyance.

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| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage through the system and develop an isolated conveyance facility. |
| <i>Approach:</i> | Develop new or expanded storage upstream of the Delta. Develop new or expanded storage within the Delta. Develop new or expanded storage in the export areas. Develop an east side Delta conveyance facility. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by increasing the amount of available storage throughout the system and increase the efficiency of deliveries to the export facilities with an isolated conveyance facility. Additional storage would provide opportunities to capture winter and flood flows originating upstream of the Delta and manage export diversions from the Delta. An isolated conveyance facility along the east side of the Delta would increase the efficiency of water movement to the export facilities and potentially provide flows for the south Delta. In addition to core actions, additional actions included in this alternative include (1) modify upstream diversion operations and Delta inflow timing patterns (actions 13.2 and 13.3) (2) Delta export management actions to modify export criteria (action 14.2, 15.1, and 15.2), and obtain approvals to fully utilize existing export capacity for yield and to reduce diversion impacts (actions 16.1 and 16.2). The increased yield from new or expanded storage upstream of the Delta and additional storage to manage Delta exports will decrease the competition for Delta supplies during critical periods. Beyond the core actions in this category, actions would be selected to (1) increase storage upstream of the Delta (actions 30.2, 31.2, and 33.2), increase storage in the export areas (actions 31.1, 32.2, and 33.1), and construct an isolated conveyance facility along the east side of the Delta away from key habitat areas (actions 35.1 and 36.1). Water supply reliability is the focus of this alternative. Reliability is improved in this alternative by increasing the yield from upstream of the Delta and developing new storage within and to the south of the Delta. These storage facilities would be managed to provide better management and opportunities for export diversions.

Preliminary Alternative 229**Reduce Competition for Delta Supplies by Expanding Storage in All Areas and Improving Through Delta Conveyance.**

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| <i>Theme:</i> | Reduce competition for water during critical periods by increasing supply availability. |
| <i>Subtheme:</i> | Increase storage through the system and expand pumping and conveyance capacities of export facilities. |
| <i>Approach:</i> | Develop new or expanded storage upstream of the Delta. Develop new or expanded storage within the Delta. Develop new or expanded storage in the export areas. Expand pumping and conveyance capacities for export facilities. |

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by increasing the amount of available storage throughout the system and increase pumping and conveyance capacities of the export facilities. Additional storage would provide opportunities to capture winter and flood flows originating upstream of the Delta and manage export diversions from the Delta. Expanded pumping and conveyance capacities of export facilities would provide more opportunity to export excess winter and flood flows in the Delta to storage facilities. Operating in this manner would increase the yield from the Delta, in addition the increased yield developed from expanded upstream storage. This additional yield would be managed to reduce the demand for Delta supplies during critical periods. In addition to core actions, additional actions included in this alternative include to (1) modify upstream diversion operations and Delta inflow timing patterns (actions 13.2 and 13.3), (2) Delta export management actions to modify export criteria (action 14.2, 15.1, and 15.2), and (3) obtain approvals to expand export capacity for yield (actions 16.3). The increased yield from new or expanded storage upstream of the Delta and additional storage to manage Delta exports will decrease the competition for Delta supplies during critical periods. Beyond the core actions in this category, actions would be selected to (1) increase storage upstream of the Delta, (2) increase storage in the export areas, and (3) convert selected Delta islands to storage facilities. Water supply reliability is the focus of this alternative. Reliability is improved in this alternative by increasing the yield from upstream of the Delta and developing new storage within and to the south of the Delta. These storage facilities would be managed to provide better management and opportunities for export diversions.

Preliminary Alternative 230

Reduce Competition for Delta Water Supplies Through Increased Flood Flow Use in the San Joaquin Valley

Theme: Reduce competition for water during critical periods by increasing supply availability.
Subtheme: Increase storage and conveyance along the eastside San Joaquin Valley (on and off-stream storage) with an isolated conveyance facility.
Approach: Increase ability to capture, convey, and manage surplus water along the eastside San Joaquin Valley to increase supply for beneficial use.

Solution Overview or Key Actions

This alternative is intended to reduce the competition for water supplies during critical periods by developing an isolated eastside San Joaquin Valley conveyance facility to directly provide increased agricultural and environmental water supply to the San Joaquin Valley and to indirectly provide increased supply to the Delta for all beneficial uses. Such a facility would capture, store and convey otherwise unregulated flood flows from the American River in the north and tie into all major eastside tributaries before terminating near Bakersfield. The captured flows would be stored to meet a portion of the needs in the San Joaquin Valley during periods of high competition for water, resulting in more water supply available to the Delta for all beneficial uses. In addition to the core actions, increased eastside conveyance and off-stream storage to capture otherwise unregulated flood flows from the American River and eastside tributaries, for use in the San Joaquin Valley thus reducing Delta export levels have been included. In addition to the core actions, actions have been included to (1) increase eastside conveyance capacity, (2) increase eastside storage, and (3) increase southern San Joaquin Valley storage. Water supply reliability is the primary objective of this alternative. Reliability is improved through the development of an eastside San Joaquin Valley conveyance and storage facility that would capture flood flows from the American River and eastside tributaries as far south as the Bakersfield area. These captured flows would be used in the San Joaquin Valley during periods of high competition, thus reducing diversions from eastside tributaries during critical periods. This would result in an increase in overall water supply reliability by fully utilizing currently unmanaged flood flows.

| Preliminary Alternative 300 | |
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| Enhancing Anadromous Fish Populations by Emphasizing Upstream Actions that Increase Fish Productivity | |
| <i>Theme:</i> | Enhance fish populations through increased productivity. |
| <i>Subtheme:</i> | Emphasize winter-run chinook salmon and other anadromous species. |
| <i>Approach:</i> | Increase natural production by upstream actions. |
| <u>Solution Overview or Key Actions</u> This alternative is intended to enhance natural production and survival of anadromous fish species that inhabit and transit the Bay-Delta, including winter-run chinook salmon. The alternative emphasizes actions that would either directly or indirectly increase anadromous fish populations by improving upstream habitat conditions. Such actions would enhance spawning habitats, reduce hazards in migration waterways, increase stream flows, reduce temperatures, and improve riverine and riparian habitat. Restoration of Bay-Delta habitat would be implemented to improve feeding, resting, and migration. To meet anadromous fish stream flow requirements and other user demands, upstream water supplies would be supplemented through incentive based conjunctive use programs. Increased anadromous fish populations would improve diversity and quality of the Bay-Delta ecosystem and provide increased sport and commercial fishery opportunities. | |

| Preliminary Alternative 301 | |
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| Enhancing Anadromous Fish Populations by Emphasizing Delta Actions that Increase Fish Productivity | |
| <i>Theme:</i> | Enhance fish populations through increased productivity. |
| <i>Subtheme:</i> | Emphasize winter-run chinook salmon and other anadromous species. |
| <i>Approach:</i> | Increase natural production by actions that can be implemented in the Delta. |
| <u>Solution Overview or Key Actions</u> This alternative is intended to enhance natural production and survival of anadromous fish by improving habitat, flow, and water quality conditions of the Bay-Delta. These improvements would be designed to favor fisheries production and restore historical conditions where feasible. Actions that increase flows for fish attraction and enhance aquatic and riparian habitat would be implemented to improve immigration conditions. Actions benefiting fry emigration would include pulse flows, riparian cover, and increased foraging opportunities. Culmination of these actions would enhance flow regimes, substrate diversity, shading and snags, detritus, and macro invertebrates. In addition to direct benefits to anadromous fish species, this alternative will indirectly improve the overall diversity and quality of the Delta, thereby enhancing other fish species populations. To meet anadromous fish flow requirements and other user demands, water supplies would be supplemented through incentive based conjunctive use programs. | |

| Preliminary Alternative 302 | |
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| Enhance Anadromous Fish Populations by Emphasizing Increasing Hatchery Production and Upstream Habitat Improvements. | |
| <i>Theme:</i> | Enhance anadromous fish populations by increasing hatchery production and improving upstream fish productivity. |
| <i>Subtheme:</i> | Emphasize winter-run chinook salmon and other anadromous species |
| <i>Approach:</i> | Operation and management implemented at hatcheries and upstream locations. |

Solution Overview or Key Actions

This alternative places primary emphasis on increasing hatchery production and improving upstream conditions to enhance anadromous fish populations. Actions to increase hatchery production of anadromous fish would receive the highest priority. Core actions to enhance fish populations, including restoration of upstream anadromous fish and riparian habitat, and improving fish passage would also be implemented at a higher level of priority emphasis, in order to substantially increase the overall production of anadromous population. Hatchery operations would be expanded to increase salmon, steelhead, and perhaps sturgeon and striped bass populations. New hatcheries would be constructed on the San Joaquin River tributaries to increase salmon and steelhead runs in that watershed. Efforts to reduce conflicts with wild population restoration would be held at the core action level.

Preliminary Alternative 303**Enhance Anadromous Fish Populations by Emphasizing Increasing Hatchery Production and In-Delta Habitat Improvements.**

Theme: Enhance anadromous fish populations by increasing hatchery production and improving Delta fish productivity.
Subtheme: Emphasize winter-run chinook salmon and other anadromous species
Approach: Operation and management actions implemented at hatcheries and in-Delta locations.

Solution Overview or Key Actions

This alternative places primary emphasis on increasing hatchery production and improving in-Delta habitat conditions to enhance anadromous fish populations. Actions to increase hatchery production of anadromous fish would receive the highest priority. Core actions to enhance fish populations, including restoration of in-Delta anadromous fish and riparian habitat would also be implemented at a higher level of priority emphasis, in order to substantially increase the overall production of anadromous population. Hatchery operations would be expanded to increase salmon, steelhead, and perhaps sturgeon and striped bass populations. New hatcheries would be constructed on the San Joaquin River tributaries to increase salmon and steelhead runs in that watershed. Efforts to reduce conflicts of hatcheries with wild population restoration would be held at the core action level.

Preliminary Alternative 304**Enhancing Anadromous Fish Populations by Emphasizing Upstream Actions that Reduce the Impacts of Diversions**

Theme: Enhance fish populations by reducing diversion impacts.
Subtheme: Emphasize winter-run chinook salmon and other anadromous species
Approach: Operation and management actions that could be implemented at upstream locations.

Solution Overview or Key Actions

This alternative places primary emphasis on improving upstream conditions for anadromous fish populations. Operations-related actions to improve flow and temperature regimes receive the highest priority. As a complement to these operational improvements, fish screening improvement, improvements to fish passage conditions in upstream areas, including the removal of natural obstacles, or the improvement of man-made impediments to passage also receive high priority. Actions to enhance fish populations, including improved fish harvest regulation and salvage management would be implemented at a relatively lower level of. Upstream habitat restoration and improvements are included to improve spawning and rearing habitat. Actions contributing to the restoration of historically higher quality Bay-Delta habitats are also recommended in order to provide improved feeding, resting, and cover areas more contiguously throughout the ranges of the anadromous species using the Delta.

Preliminary Alternative 305**Enhance Anadromous Fish Populations by Emphasizing In-Delta Actions that Reduce the Impacts of Diversions**

Theme: Enhance fish populations by reducing diversion impacts.
Subtheme: Emphasize winter-run chinook salmon and other anadromous species
Approach: Operation and management actions that could be implemented at in-Delta locations.

Solution Overview or Key Actions

This alternative places primary emphasis on improving in-Delta conditions for anadromous fish populations. Actions emphasizing the restoration of extensive historically higher quality Bay-Delta aquatic habitats receive high priority. Inflow, outflow, and export management actions provide more favorable salinity/freshwater regimes, and substantially improve estuarine conditions. Improved fish harvest regulation and salvage management receive high priority in order to substantially increase the overall rate of anadromous population increases through in-Delta actions. Fish screening and habitat improvements, and the removal of impediments to fish passage conditions in upstream areas would be implemented in coordination with in-Delta actions.

Preliminary Alternative 306**Improve Conditions for Winter-Run Chinook salmon and other Anadramous Fish Species by Reducing the Impacts of Diversions Through the Installation and Operation of Fish Screens and Barriers Upstream from the Delta**

Theme: Enhance anadramous fish populations through reduced diversion impacts.
Subtheme: Increase anadramous fish populations.
Approach: Installation and operation of upstream fish screens and barriers.

Solution Overview or Key Actions

The overall strategy for this alternative is to enhance anadromous fish populations (including winter-run chinook salmon) by implementing upstream actions to improve fish passage. These actions were chosen to produce large-scale reductions in entrainment by implementing extensive fish screening programs in the upstream tributaries of the Delta. Improvements for upstream migration also feature prominently in this alternative, providing flow conditions and a system of barriers that recruit more fish for upstream spawning. In addition, pulse flows have been included to enhance down stream migration of juvenile fish. When implemented in concert with the core actions, this strategy builds considerable momentum and provides considerable benefits for winter-run salmon and other anadromous fish species.

Preliminary Alternative 307

Improve Conditions for Winter-run Chinook Salmon and Other Anadromous Fish Species by Reducing the Impacts of Diversion Through the Installation and Operation of Fish Screens and Barriers Within the Bay-delta System

Theme: Enhance anadromous fish populations through reduced diversion impacts.

Subtheme: Increase anadromous fish populations.

Approach: Installation and operation of in-Delta fish screens and barriers.

Solution Overview or Key Actions

This alternative focuses on reducing the conflict between anadromous fish species (including winter-run chinook salmon) and water diversions through the implementation of in-Delta actions to reduce entrainment and improve fish passage. In addition to the core actions, additional actions focusing on in-Delta fish screening and installation and operation of barriers to guide fish movement would be implemented. These actions would increase anadromous fish populations.

Preliminary Alternative 308

Reduce Upstream Anadromous Fish Diversion Impacts and Enhance Outmigration Through the Bay-delta Using Consolidated Diversions and Flow Management

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| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing winter run and other anadromous fishery. |
| <i>Approach:</i> | Consolidating and relocating diversions with emphasis on measures taken upstream of the Delta. |
| <u>Solution Overview or Key Actions</u> | |
| Alternative 308 focuses on enhancing the anadromous fishery by reducing the impacts of upstream diversions. The principal focus of actions is the consolidation of diversions to minimize potential unscreened entrainment of smolts and maximize their out-migration success. Coordinated flow management as mitigated by moderate export enhancements assures successful outmigration of smolts. | |

| Preliminary Alternative 309 | |
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| Reduce Anadromous Fish Diversion Impacts in the Delta and Enhance Fish Passage Through the Bay-delta Using Consolidated In-delta Diversions and Flow Management | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing winter run and other anadromous fishery. |
| <i>Approach:</i> | Consolidating and relocating diversions with emphasis on measures taken in the Delta. |
| <u>Solution Overview or Key Actions</u> | |
| Alternative 309 focuses on enhancing the anadromous fishery by reducing the impacts due to in-Delta diversions. The principal focus of actions is the consolidation of diversions to minimize potential unscreened entrainment of migrating smolts and maximize their out-migration success. Coordinated flow management as mitigated by moderate export enhancements assures successful out-migration of smolts. | |

| Preliminary Alternative 310 | |
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| Enhance Bay-Delta Native Fish Species by Emphasizing Upstream Actions that Increase Fish Productivity | |
| <i>Theme:</i> | Enhance fish populations through increased productivity. |
| <i>Subtheme:</i> | Emphasize fish species native to the Bay-Delta, including the Delta Smelt. |
| <i>Approach:</i> | Increase natural production by upstream actions. |

Solution Overview or Key Actions

This alternative is intended to enhance natural production and survival of native Delta fish species, including the Delta smelt and Sacramento splittail, by improving flows and ecological conditions of upstream watersheds. Actions in this alternative would control and increase flows, reduce in-flow temperatures, and improve in-flow water quality. These actions would directly enrich the Delta aquatic food chain by increasing the amount of detritus and macro invertebrates drifting into the Delta, and indirectly by enhancing conditions for anadromous fish productivity. This alternative would improve diversity and ecological quality of the Delta and would increase natural fish production, thereby potentially increasing resources for sport and commercial fisheries. To minimize water supply effects to other water users, an incentive based conjunctive use program would be implemented that encourages users to supplement surface water demand with ground water supplies. On- and off-stream storage facilities may also be constructed and existing on-stream storage reservoirs may be enlarged to meet instream flow goals.

Preliminary Alternative 311

Enhance Bay-delta Native Fish Species by Emphasizing Delta Actions That Increase Fish Productivity

Theme: Enhance fish populations through increased productivity.

Subtheme: Emphasize fish species native to the Bay-Delta, including the Delta Smelt.

Approach: Increase natural production by actions that can be implemented in the Delta.

Solution Overview or Key Actions

This alternative is intended to enhance natural production and survival of native Delta fish species, including the Delta smelt and Sacramento splittail. The alternative emphasizes actions that would either directly or indirectly increase Delta native fish populations by improving ecological conditions in the Delta. Such actions would increase flows, reduce temperatures, and improve aquatic and riparian habitat, including wetlands. These actions would increase detritus and enrich the aquatic food chain and provide shading, snags, and other physical features paramount to increasing natural fisheries production. This alternative would increase natural fish production, improve diversity and ecological quality of the Delta, and may indirectly benefit other fish species, thereby increasing sport and commercial fisheries. To minimize water supply effects to other water users, an incentive based conjunctive use program would be implemented that encourages users to supplement surface water demand with ground water supplies.

| Preliminary Alternative 313 | |
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| Enhance Bay-Delta Native Fishes by Emphasizing Increasing Hatchery Production and In-Delta Habitat Improvements. | |
| <i>Theme:</i> | Enhance anadromous fish populations by increasing hatchery production and improving in-Delta fish productivity. |
| <i>Subtheme:</i> | Emphasize delta smelt and other native Bay-Delta fish species. |
| <i>Approach:</i> | Operation and management actions that could be implemented at hatcheries and in-Delta locations |
| <u>Solution Overview or Key Actions</u> This alternative places primary emphasis on increasing hatchery production and improving in-Delta conditions to enhance native fish populations. Actions to increase hatchery production of Delta fish would receive the highest priority. Core actions to enhance fish populations, including restoration of in-Delta fish and riparian habitat would also be implemented at a higher level of priority emphasis, in order to substantially increase the overall production of native fish populations. Hatchery operations would be expanded to increase delta smelt, Sacramento perch, and perhaps sturgeon and longfin smelt populations. Efforts to reduce conflicts with wild population restoration would be held at the core action level. | |

| Preliminary Alternative 315 | |
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| Enhance Bay-Delta Native Species Populations Emphasizing In-Delta Operation And Management Actions That Reduce The Impacts Of Diversions | |
| <i>Theme:</i> | Enhance fish populations by reducing diversion impacts |
| <i>Subtheme:</i> | Emphasize Bay-Delta native species |
| <i>Approach:</i> | Operation and management actions that could be implemented at Delta locations |
| <u>Solution Overview or Key Actions</u> The emphasis of this alternative is to enhance Bay-Delta native fish populations by coordinating operational releases, habitat restoration actions, and improved management of diversion/fish interactions. It emphasizes actions in Delta locations, but also includes upstream actions at some core level of implementation to ensure that the entire range of fisheries habitats of importance are addressed. | |

| Preliminary Alternative 317 |
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| Improve Conditions for Bay-Delta Native Fish Species by Reducing the Impacts of Diversion through Installation and Operation of in-Delta Fish Screens and Barriers | |
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| <i>Theme:</i> | Enhance populations of Bay-Delta native fish species through reduced diversion impacts. |
| <i>Subtheme:</i> | Increase Bay-Delta native fish populations. |
| <i>Approach:</i> | Installation and operation of in-Delta fish screens and barriers. |
| <u>Solution Overview or Key Actions</u> This alternative has been geared toward improving conditions for Delta native fishes with a main focus on using in-Delta improvements to reduce entrainment. Other actions are also presented which bolster population increases, including predator control programs, utilization of real-time monitoring and adaptive management, and manage Delta outflow. These actions are combined to provide for expedited population recovery for key Delta species. | |

| Preliminary Alternative 319 | |
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| Reduce Delta Diversion Impacts to Indigenous Bay-Delta Resident Fishery by Consolidated In-Delta Diversions and Flow Management | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing indigenous Bay-Delta resident fishery. |
| <i>Approach:</i> | Consolidating and relocating diversions with emphasis on measures taken in the Delta. |
| <u>Solution Overview or Key Actions</u> Alternative 319 focuses on enhancing the Delta resident fishery by reducing the impacts resulting from in-Delta diversions. The principal focus of actions is the consolidation of all diversions by an eastside isolated Delta transfer facility to eliminate potential unscreened entrainment of fishes. Coordinated flow management would be more than mitigated by moderate export enhancements, and vulnerability would be effectively eliminated. | |

| Preliminary Alternative 320 | |
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| Enhancing Anadromous Fish Populations by Emphasizing Upstream Actions That Increase Fish Productivity | |
| <i>Theme:</i> | Enhance fish populations through increased productivity. |
| <i>Subtheme:</i> | Equally emphasize anadromous and Bay-Delta native species. |
| <i>Approach:</i> | Increase natural production |

Solution Overview or Key Actions

This alternative is intended to achieve sustainable production and survival of fish species that either reside in, or use the Bay-Delta. It emphasizes actions that would either directly or indirectly increase all resident and anadromous fish populations by improving Delta and upstream habitat conditions. Such actions would improve spawning habitats, reduce hazards in migration waterways, increase stream flows, reduce temperatures, and improve riverine and riparian habitat. Restoration of Bay-Delta habitat would be implemented to improve feeding, resting, and migration. To meet anadromous fish instream flow requirements and other user demands, upstream water supplies will be augmented through incentive-based conjunctive use programs. Increased fish populations will improve diversity and quality of the Bay-Delta ecosystem and provide increased sport and commercial fishery opportunities.

Preliminary Alternative 321**Enhancing Anadromous Fish Populations by Emphasizing In-Delta Actions that Increase Fish Productivity**

Theme: Enhance fish populations through increased productivity.

Subtheme: Equally emphasize anadromous and Bay-Delta native species.

Approach: Increase natural production.

Solution Overview or Key Actions

This alternative is intended to achieve improvements in the production of Bay-Delta native fish species. It emphasizes actions that could be implemented in the Delta, including extensive aquatic habitat restoration, and inflow and export management. The overall objectives of this alternative are the protection of existing habitat values, restoration of degraded habitats, and the extension of high quality estuarine conditions throughout the Delta system.

Preliminary Alternative 323**Enhance Anadromous and Bay-Delta Native Resident Fishes by Emphasizing Increasing Hatchery Production and In-Delta Habitat Improvements**

Theme: Enhance anadromous and Delta native resident fish populations by increasing hatchery production and improving in-Delta fish productivity.

Subtheme: Emphasize winter-run chinook salmon and Delta smelt and other anadromous and native Bay-Delta fish species.

Approach: Operation and management actions that could be implemented at hatcheries and in-Delta locations.

Solution Overview or Key Actions

This alternative places primary emphasis on increasing hatchery production and improving in-Delta conditions to enhance anadromous and native resident fish populations. Actions to increase hatchery production of Delta fish would receive the highest priority. Core actions to enhance fish populations, including restoration of in-Delta fish and riparian habitat would also be implemented at a higher level of priority emphasis, in order to substantially increase the overall production of anadromous and Delta native resident fish populations. Hatchery operations would be expanded to increase winter-run chinook salmon, other salmon and steelhead runs, Delta smelt, striped bass, and perhaps sturgeon, Sacramento perch, and longfin smelt populations. Efforts to reduce conflicts with wild population restoration would be held at the core action level.

Preliminary Alternative 324

Enhancing Anadromous And Bay-Delta Native Species Populations Emphasizing Upstream Operation And Management Actions That Reduce The Impacts Of Diversion

Theme: Enhance fish populations by reducing diversion impacts

Subtheme: Equally emphasize both anadromous and Bay-Delta native species

Approach: Operation and management actions that could be implemented at upstream locations.

Solution Overview or Key Actions

The emphasis of this alternative is to enhance all Bay-Delta native and anadromous fish populations by coordinating operational releases, habitat restoration actions, improved management of diversion fish interactions, and system reliability actions. It emphasizes actions in upstream locations, but also includes in-Delta actions at some core level of implementation to ensure that the entire range of fisheries habitats of importance are addressed.

Preliminary Alternative 325

Enhancing Anadromous And Bay-Delta Native Species Populations Emphasizing In-Delta Operation And Management Actions That Reduce The Impacts Of Diversions

Theme: Enhance fish populations by reducing diversion impacts

Subtheme: Equally emphasize both anadromous and Bay-Delta native species

Approach: Operation and management actions that could be implemented at Delta locations

Solution Overview or Key Actions

The emphasis of this alternative is to enhance all Bay-Delta native and anadromous fish populations by coordinating operational releases, habitat restoration actions, improved management of diversion/fish interactions, and system reliability actions. It emphasizes actions in Delta locations, but also includes upstream actions at some core level of implementation to ensure that the entire range of fisheries habitats of importance are addressed.

Preliminary Alternative 326**Improve Conditions for Anadromous and Bay-Delta Native Fish Species by Reducing the Impacts of Diversion Through the Installation and Operation of Upstream Fish Screens and *BARRIERS***

Theme: Enhance populations of anadromous and Bay-Delta native fish species through reduced diversion impacts.

Subtheme: Increase anadromous and Bay-Delta native fish populations.

Approach: Installation and operation of upstream fish screens and barriers

Solution Overview or Key Actions

This alternative has been developed to enhance populations of both Delta native fishes and anadromous fish species, using upstream measures for improving fish passage. This action includes comprehensive screening actions to reduce entrainment of both anadromous species and other native Delta species that spawn upstream of the Delta. In addition, other measures (e.g. barriers and flow improvements) have been included to maximize migration success. This alternative includes upstream flow management measures to ensure benefits for Delta native species by controlling Suisun Bay salinity at key times to improve rearing habitat. These alterations of flow require some coordination and planning for increased water supply and improved operational flexibility to ensure exports for water users south of the Delta.

Preliminary Alternative 327**Improve Conditions for Anadromous and Bay-Delta Native Fish Species by Reducing the Impacts of Diversion Through the Installation and Operation of in-Delta Fish Screens and Barriers**

Theme: Enhance populations of anadromous and Bay-Delta native fish species through reduced diversion impacts.

Subtheme: Increase anadromous and Bay-Delta native fish populations.

Approach: Installation and operation of in-Delta fish screens and barriers.

Solution Overview or Key Actions

The overall approach for this alternative is in-Delta improvements for both anadromous and Delta native fish species to reduce entrainment and improve fish passage. Beneficial actions for special status fishes have also been included to address declining populations of winter-run chinook salmon, Delta smelt, longfin smelt, and Sacramento splittail. Actions included in this alternative combine reductions in entrainment, more successful fish migration, improved flow conditions, with provisions for increased operational flexibility and additional storage south of the Delta. These actions in concert provide considerable improvement of existing fisheries resources.

Preliminary Alternative 329

Reduce Delta Diversion Impacts to All Indigenous Fish by Consolidated In-Delta Diversions and Flow Management

Theme: Enhance fishery population through reduced diversion impacts.

Subtheme: Enhancing all indigenous fishery.

Approach: Consolidating and relocating diversions with emphasis on measures taken in the Delta.

Solution Overview or Key Actions

Alternative 329 focuses on enhancing the fishery by reducing the impacts resulting from in-Delta diversions. The principal focus of actions is consolidating diversions to minimize potential unscreened entrainment of migrating smolts and maximize their out-migration success. Coordinated flow management as mitigated by moderate export enhancements assures successful out-migration of smolts.

Preliminary Alternative 330

Enhance Anadromous Fish Populations by Increasing Natural and Hatchery Production.

Theme: Enhance anadromous fish populations

Subtheme: Increase hatchery production and improve Delta and upstream productivity.

Approach: Increase winter-run chinook salmon and other salmon and steelhead populations by improving habitat and supplementing populations with hatchery production.

Solution Overview or Key Actions

- Expand hatchery capacities for winter run salmon and other anadromous species including other runs of chinook salmon, steelhead, and striped bass.
- Construct new salmon and steelhead hatcheries on the San Joaquin River.
- Construct production hatchery facilities for sturgeon.
- Implement tagging of hatchery-bred fish to allow (1) assessment of effects on wild fish, and (2) selective fisheries that would protect wild fish from overharvest.
- Restore modest levels of shallow water, riverine, riparian, and wetland habitats in the Delta.
- Restore modest levels of of channel, riparian, and wetland habitat in upstream areas of Sacramento and San Joaquin rivers and tributaries.
- Change upstream reservoir operations and Delta inflow timing pattern.

Preliminary Alternative 331**Enhance Bay-Delta Native Fish Populations by Increasing Natural and Hatchery Production**

Theme: Enhance Bay-Delta native fish populations

Subtheme: increase hatchery production and improve Delta productivity.

Approach: Emphasize is placed on increasing delta smelt populations by improving habitat and supplementing populations with hatchery production

Solution Overview or Key Actions

- Construct production hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.
- Implement tagging (some type of marking) of hatchery-bred fish to allow (1) assessment of effects on wild fish, and (2) selective fisheries (not for delta smelt) that would protect wild fish from overharvest.
- Restore modest levels of shallow water, riverine, riparian, and wetland habitats in the Delta.
- Change upstream reservoir operations and Delta inflow timing pattern.

Preliminary Alternative 332

Increase populations of anadromous and Bay-Delta native fish through habitat improvements and hatchery production.

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| <i>Theme:</i> | Increase Populations of anadromous and Bay-Delta native fishes |
| <i>Subtheme:</i> | Improve fishery habitat conditions |
| <i>Approach:</i> | Increase hatchery production |
| <p><i>Habitat restoration, upstream</i> — Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding habitats, and improve fish survival.</p> <p><i>Channel and floodway habitat improvement</i>— Expand floodway habitat, channels, and meander belts in the Bay-Delta and in rivers and tributaries upstream of the Delta to restore fish spawning, rearing, feeding habitats, and improve fish survival.</p> <p><i>Habitat management</i> — Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations.</p> <p><i>Introduced/nuisance species</i> — Reduce the numbers of nuisance species from key habitat and modify habitat to limit introduced/nuisance species.</p> <p><i>Reservoir operations modification</i> — Change reservoir operations and Delta inflow patterns to benefit fish habitat and production.</p> | |

| Preliminary Alternative 333 | |
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| Reduce Anadromous Fish Diversion Impacts Along All Migration Routes by Consolidating Diversions and Installing Barriers | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing winter run and other anadromous fishery. |
| <i>Approach:</i> | Consolidate diversions and install barriers along principal migration. |
| <p><u>Solution Overview or Key Actions</u></p> <p>Alternative 333 focuses on enhancing the anadromous fishery by reducing diversion impacts along the entire migration route. The principal focus of actions is combined use of consolidated diversions, screens, and barriers to minimize potential unscreened entrainment of migrating smolts and maximize their out-migration success. An isolated conveyance around rearing habitats and export areas both minimizes diversion impacts and mitigates pulse flow losses. Delta agricultural diversions would be consolidated to less deleterious locations with both screens and barriers to avoid entrainment losses. Export vulnerability would be reduced, and water quality would be improved. Coordinated pulse flow management as mitigated by moderate export enhancements assures successful out-migration of smolts.</p> | |

| Preliminary Alternative 334 |
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| Reduce Bay-Delta Resident Fishery Diversion Impacts by Consolidating Diversions and Installation of Barriers | |
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| <i>Theme:</i> | Enhance indigenous Bay-Delta resident fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing all indigenous Bay-Delta resident fisheries. |
| <i>Approach:</i> | Consolidate diversions and install barriers. |
| <u>Solution Overview or Key Actions</u> Alternative 334 focuses on enhancing the Bay-Delta resident fisheries with the principal focus of actions being combined use of consolidated diversions, screens, and barriers. Isolated conveyance around the Delta both minimizes diversion impacts and mitigates pulse flow water supply losses. This facility would also serve Delta upland agricultural diversions. Both export and ecosystem water quality would be assured by dedicated capacity in the facility. Vulnerability of ecosystem and export supplies to a Delta calamity would be nearly completely eliminated by isolating conveyance east of the Delta. Pulse flow enhancements as fully mitigated by increased export capacity assure successful regulation of salinity gradients. | |

| Preliminary Alternative 335 | |
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| Reduce All Fish Diversion Impacts Along All Critical Regions by Consolidating Diversions and Installing Barriers | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing all indigenous Bay-Delta dependent fisheries. |
| <i>Approach:</i> | Consolidate diversions and install barriers along principal migration. |
| <u>Solution Overview or Key Actions</u> Alternative 335 focuses on enhancing the anadromous and other Bay-Delta fisheries by reducing diversion impacts along the entire migration route. The principal focus of actions is combined use of consolidated diversions, isolated facilities, screens, and barriers. Isolated conveyance around rearing habitats and the Delta both minimizes diversion impacts and mitigates pulse flow water supply losses. This facility would also serve Delta upland agricultural diversions. Both export and ecosystem water quality would be assured by dedicated capacity in the facility. Vulnerability of ecosystem and export supplies to a Delta calamity would be nearly completely eliminated by isolating the conveyance east of the Delta. Coordinated pulse flow enhancements as fully mitigated by export enhancements assure successful out-migration of smolts and changes in "X2" isohaline location | |

| Preliminary Alternative 336 | |
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| Reduce Anadromous Fishery Diversion Impacts by Consolidating Diversions and Operational Modifications | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing anadromous fisheries. |
| <i>Approach:</i> | Consolidate diversions and modify operations. |
| <u>Solution Overview or Key Actions</u> Alternative 336 is directed at anadromous fisheries actions emphasizing consolidated diversions and particularly modifying operations. Relocated diversions in the upper Sacramento River, coupled with strategically managed barriers and flow modifications, offer promise for anadromous fishery management. A small isolated westside Delta conveyance partially mitigates pulse flow water supply losses to exports while removing export diversions from critical habitat during migration periods. Conjunctive use in the upper basin and timely allowance for full use of export capacity would mitigate water supply losses resulting from pulse flows. Adaptive management of pulse flows would allow strategic triggers for out-migration of smolts. Attractive flows would be used to guide spawning migration. Vulnerability of export supplies to a Delta calamity would be partially. | |

| Preliminary Alternative 337 | |
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| Reduce Bay-Delta Resident Fishery Diversion Impacts by Consolidating Diversions and Operational Modifications | |
| <i>Theme:</i> | Enhance Indigenous Bay-Delta Resident fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing all indigenous Bay-Delta resident fisheries. |
| <i>Approach:</i> | Consolidate diversions and Modify operations. |
| <u>Solution Overview or Key Actions</u> Alternative 337 focuses on enhancing the Bay-Delta resident fisheries with the principal focus of actions being combined use of consolidated diversions and modifying operations. An Isolated conveyance around the Delta both minimizes diversion impacts and mitigates pulse flow water supply losses. This facility would also serve Delta upland agricultural diversions. A dedicated portion of capacity in the facility combined with adaptive management of pulse flows would allow strategic delivery of the pulse for ecosystem water management. Vulnerability of ecosystem and export supplies to a Delta calamity would almost be eliminated by isolating conveyance east of the Delta. Pulse flow enhancements as fully mitigated by increased export capacity assures successful regulation of salinity gradients. | |

| Preliminary Alternative 338 | |
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| Reduce All Fishery Diversion Impacts by Consolidating Diversions and Operational Modifications | |
| <i>Theme:</i> | Enhance fishery population through reduced diversion impacts. |
| <i>Subtheme:</i> | Enhancing all Bay-Delta dependant fisheries. |
| <i>Approach:</i> | Consolidate diversions and Modify operations. |
| <u>Solution Overview or Key Actions</u> Alternative 338 addresses the needs of all Bay-Delta dependant fisheries with the actions focused on consolidated diversions and modifying operations. Relocated Diversions in the upper Sacramento River coupled with strategically managed barriers and flow modifications offers promise for anadromous fishery management. An isolated conveyance around the Delta both minimizes Delta diversion impacts and mitigates pulse flow water supply losses to exports. Conjunctive use in the upper basin would mitigate upper basin water supply losses resulting from pulse flows. The isolated Delta facility would remove impacts resulting from Delta agricultural diversions. A dedicated portion of capacity in the facility combined with adaptive management of pulse flows would allow strategic delivery of the pulse for ecosystem water management. Pulse flow enhancements as fully mitigated by increased export capacity assures successful regulation of salinity gradients. Vulnerability of ecosystem and export supplies to a Delta calamity would almost be eliminated by isolating conveyance east of the Delta. | |

| Preliminary Alternative 340 | |
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| Increase Fish Populations Using Several Approaches | |
| <i>Theme:</i> | Increase populations of anadromous and Bay-Delta native fish |
| <i>Subtheme:</i> | Balance several contributing approaches |
| <i>Approach:</i> | Habitat improvements, reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and hatchery production. |

Solution Overview or Key Actions

Habitat Restoration---Restore riverine, riparian, wetland, and adjacent terrestrial habitat, and expand floodway habitat, channels, and meander belts in the Bay-Delta and upstream in rivers and tributaries to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival. Isolate Delta export diversions to restore Delta habitat conditions.

Habitat Management---Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

Control Introduced/Nuisance/Predator Species---Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

Hatcheries---Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.

Project Operations---Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

Reduce Diversions and Diversion Effects---Modify diversion timing, increase diversion capacity to allow less diversion during key periods, acquire water supplies for fish to improve flows, improve existing screens and install new screens, consolidate diversions, enforce screening requirements, and convert industrial water use to cooling towers. Isolate Delta, Sacramento River, and San Joaquin River diversions by constructing conveyance facilities.

Preliminary Alternative 341

Increase Production of Native Anadromous and Bay-delta Resident Fish

Theme: Increase production of native anadromous and Bay-Delta resident fish

Subtheme: Maximum reasonable levels of habitat improvements,

Approach: Reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and supportive hatchery activities.

Solution Overview or Key Actions

Habitat Restoration---Restore riverine, riparian, wetland, and adjacent terrestrial habitat, and expand floodway habitat, channels, and meander belts in the Bay-Delta and upstream in rivers and tributaries to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival.

Habitat Management---Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

Control Introduced/Nuisance/Predator Species---Reduce the numbers of nuisance and predator species from key habitats and export facilities, and modify habitat to limit introduced/nuisance species.

Hatcheries---Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin to develop new self-sustaining wild runs; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch to restore stocks to self-sufficient levels.

Project Operations---Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

Reduce Diversions and Diversion Effects---Modify diversion timing, increase diversion capacity to allow less diversion during key periods, acquire water supplies for fish to improve flows, improve existing screens and install new screens, consolidate diversions, enforce screening requirements, and convert industrial water use to cooling towers. Isolate Delta, Sacramento River, and San Joaquin River diversions by constructing conveyance facilities.

Preliminary Alternative 342

Increase Populations of Bay-delta Native Fish

Theme: Increase populations of Bay-Delta native fish

Subtheme: Balanced management

Approach: Habitat improvements, reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and hatchery production.

Solution Overview or Key Actions

Habitat Restoration---Restore riverine, riparian, wetland, and adjacent terrestrial habitat, and expand floodway habitat, channels, and meander belts in the Bay-Delta to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival. Isolate Delta export diversions to restore Delta habitat conditions.

Habitat Management---Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

Control Introduced/Nuisance/Predator Species---Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

Hatcheries---Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.

Project Operations---Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

Reduce Diversions and Diversion Effects---Modify diversion timing, increase diversion capacity to allow less diversion during key periods, acquire water supplies for fish to improve flows, improve existing screens and install new screens, consolidate diversions, enforce screening requirements, and convert industrial water use to cooling towers. Isolate Delta diversions by constructing conveyance facilities.

Preliminary Alternative 343

Modest Enhancement of Native Fish Populations

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| <i>Theme:</i> | Increase populations of native anadromous and Bay-Delta resident fish |
| <i>Subtheme:</i> | Modest levels of habitat improvements |
| <i>Approach:</i> | Reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and supportive hatchery activities. |

Solution Overview or Key Actions

Habitat Restoration---Restore riverine, riparian, wetland, and adjacent terrestrial habitat, and expand floodway habitat, channels, and meander belts in the Bay-Delta and upstream in rivers and tributaries to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival. Isolate Delta export diversions to restore Delta habitat conditions.

Habitat Management---Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

Control Introduced/Nuisance/Predator Species---Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

Hatcheries---Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.

Project Operations---Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

Reduce Diversions and Diversion Effects---Modify diversion timing, increase diversion capacity to allow less diversion during key periods, acquire water supplies for fish to improve flows, improve existing screens and install new screens, consolidate diversions, enforce screening requirements, and convert industrial water use to cooling towers. Isolate Delta, Sacramento River, and San Joaquin River diversions by constructing conveyance facilities.

Preliminary Alternative 344

Maximum Diversion Impacts Reduction

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| <i>Theme:</i> | Reduce direct and indirect impacts of upstream and in-Delta diversions |
| <i>Subtheme:</i> | Operations and management strategies |
| <i>Approach:</i> | Fish screens, barriers, diversion consolidations, and water quality improvements while maintaining or augmenting water supply delivery capacity. |

Solution Overview or Key Actions

Manage Delta Inflow/Outflow/Exports — Operate Sacramento and San Joaquin reservoirs to provide increased instream flows, reduced stranding, and reduced temperatures. Create a Delta watermaster's office to manage inflows, central channel operations, and outflows.

Manage Diversions and Fish Screens — Consolidate and relocate all diversions to less sensitive environmental areas, with improved designs to reduce potential entrainment. Adjust the timing for in-Delta and Montezuma Salinity Control Gates diversions, and relocate Delta pumping plants away from key habitat. Improve fish screen mesh sizes and protection performance, and install more fish screens.

Install Barriers to Guide Fish Movement/Control Salinity— Install barriers to keep upstream migrants in the Sacramento River, and to block fish movement into Old River. Construct barriers diverting outmigrants from the Sacramento River directly into western Delta channels to minimize their vulnerability to either existing or relocated export pumps. Install salinity control barriers.

Increase Rates of Diversion Capacity— Obtain approvals for fully utilizing existing export capacity during less environmentally sensitive times, and enlarge export pumping and conveyance capacities.

Preliminary Alternative 345

Optimize Ecosystem Health

Theme: Optimize ecosystem health

Subtheme: Balanced, comprehensive ecosystem approach

Approach: Improvements in water quality, habitat, water conservation, and flows throughout the basin.

Solution Overview or Key Actions

Habitat Restoration--- Restore riverine, riparian, wetland, and adjacent terrestrial habitat, and expand floodway habitat, channels, and meander belts in the Bay-Delta and upstream in rivers and tributaries to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival. Improve flows in the basin to better emulate the natural flows of the system. Isolate a portion of the Delta export diversions to restore Delta habitat conditions.

Habitat Management--- Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

Control Introduced/Nuisance/Predator Species--- Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

Water Quality--- Improve watershed management, and reduce pollutant inputs from agricultural and mine drainage, dredging, and urban and wastewater discharges.

Water Conservation--- Reduce demands of water in and out of basin by promoting water conservation, land retirement and fallowing, water pricing reforms, groundwater banking and conjunctive use, and institutional changes in water management.

Project Operations--- Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production, and water quality.

Reduce Diversions and Diversion Effects--- Modify diversion timing, increase diversion capacity to allow less diversion during key periods, and acquire water supplies for fish to improve flows. Isolate Delta diversions by constructing a small isolated transfer facility.

Preliminary Alternative 346

Isolate/Reduce Diversion Impacts

Theme: Increase Delta fisheries without reducing export supply capacity.

Subtheme: Construct an isolated Delta facility

Approach: Coordinate with strategic releases and barrier operations

Solution Overview or Key Actions

Construction & Improvement of Conveyance Facilities— Construct an eastside isolated transfer system/conveyance facility to avoid entrainment of resident and anadromous fisheries. Dedicate capacity as feasible overland service to Delta agriculture to reduce entrainment. Install barriers at environmentally sensitive small diversions, and screens and barriers at larger diversions.

Increase Rates of Diversion Capacity— Obtain approvals for fully utilizing existing export capacity during less environmentally sensitive times, and enlarge export pumping and conveyance capacities.

Manage Delta Inflow— Coordinate water temperature and pulse flow releases to encourage the movement of various species to target locations. Schedule enhanced pulse flow releases and modified export operations using extensive adaptive management. Assure positive flow with appropriate salinity gradients for improved ecosystem health.

Preliminary Alternative 347

Improved Flows, Habitat, Quality, and Stability

Theme: Maximize Delta inflows and in-Delta and upstream aquatic, riparian, and wetland habitat

Subtheme: Maintain water quality, and levee stability

Approach: Benefit fish populations without new in-water construction, conveyance, or other major infrastructure modifications.

Solution Overview or Key Actions

Manage Delta Inflow/Outflow/Exports — Operate Sacramento and San Joaquin reservoirs to provide increased instream flows, reduced stranding, and reduced temperatures. Create a Delta watermaster's office to manage inflows, central channel operations, and outflows.

Manage Diversions and Fish Screens — Adjust the timing for in-Delta and Montezuma Salinity Control Gates diversions to optimize control of the 2ppt isohaline and low-salinity habitat zone.

Improve Flooding & Seismic Protections— Reconstruct levees to higher design and seismic standards, and relocate unstable levees to more stable sites.

Preliminary Alternative 348

Improved Operations, Conveyance, and Storage

Theme: Improve fish populations

Subtheme: Increase flexibility in providing water for Delta and anadromous species.

Approach: Emphasize operational releases, construction of a small eastside transfer facility, and expanded off-stream storage

Solution Overview or Key Actions

Manage Delta Inflow/Outflow/Exports — Operate upstream reservoirs for increased instream flows, and reduced temperatures. Create a Delta watermaster's office to manage inflows, central channel operations, and outflows

Construct Conveyance Facility— Construct small eastside isolated transfer facility for balanced inflow and conveyance benefits.

Expand Off-Stream Storage— Enlarge existing off-stream storage reservoirs, increase flows from the Sacramento River to the central Delta by increasing the capacities of existing east-side channels. Modify Delta levees to increase flow cross-sections for more effective. Construct small new off-stream storage reservoirs for export areas.

Improve Flooding & Seismic Protections— Reconstruct levees to higher design and seismic standards.